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CONTENTS

	PAGE	RUSS. PAGE
We Will Meet the Resolutions of the 22nd Conference of the Communist Party of the Soviet Union	151	1
THE BLAST FURNACE INDUSTRY		
The Effect of Material Transfer on the Change in Sieve Composition of Sinter. L. M. Rudakov and I. I. Gorshtein	156	4
The Optimum Composition of Blast-Furnace Slag at the Southern Plants. N. N. Chernov and A. N. Chechuro	159	6
In the Blast-Furnace Department of the Magnitogorsk Metallurgical Combine. V. P. Emel'yanov	161	8
THE STEELMAKING INDUSTRY		
An Electric Furnace with Sloping Walls and Split Housing. I. I. Kulakov	165	11
The Quality of Converter Metal. N. I. Beda and P. Ya. Ryzhkov	168	13
At the Magnitogorsk Metallurgical Combine Open-Hearth Department	171	16
The Use of Sorted and Graded Scrap	173	18
Cleaning the Regenerator Checkerworks of Open-Hearth Furnaces. G. A. Petrov, A. P. Klyucherov, and B. N. Shisharin	174	19
ROLLED AND TUBULAR PRODUCTS		
Economical Rolled Shapes from Alloy Steel. M. V. Shuralev and S. G. Nekrasov	177	21
Production of Rolled Ball-Bearing Steel. G. A. Khasin and V. G. Chikina	179	23
Designing Box Passes. I. P. Shulaev	183	26
An Efficient Technology for Grinding Rolled Steel. V. K. Pasechnik	186	28
Heat Insulation of the Hearth Pipes. V. N. Astsaturov	188	30
Device for Manipulating Strip. V. I. Sorokin and L. N. Goredetskii	190	32
Elimination of Dust from the Working Stand of a Mill. M. V. Pal'shin	192	33
EXPERIENCE OF INNOVATORS		
Creative Cooperation. Ya. R. Bukhman	193	34
METALLURGY ABROAD		
Charging the Caldron	194	35
Three Events	196	36
INTERNATIONAL RELATIONS		
In the Land of Constant Sunshine. V. A. Podzerko	197	37
NEW BOOKS		
How the Plant Became Profitable, I. M. Ektov. Reviewed by M. Kamenskii	200	39
Improving the Sanitary Conditions of Iron-Ore Sinter Plants. A. V. Sheleketin and N. S. Karpushinskii. Reviewed by R. S. Suprunenko	201	39
CHRONICLE		
The Fourth Plenum of the Scientific-Technical Societies of Ferrous and Nonferrous Metallurgy. I. Polyak	202	40

WE WILL MEET THE RESOLUTIONS OF THE 22nd CONFERENCE OF THE COMMUNIST PARTY OF THE SOVIET UNION

V. A. Podzerko

President of the Central Committee of the Metallurgical Industry Trade Union
Translated from Metallurg, No. 4, pp. 1-3, April, 1961

Soviet metallurgists have made remarkable advances in the last two years of the 7-Year Plan. The whole country is proud of their efforts. In these two years there has been a considerable increase in the volume of production in iron, steel,and rolled stock, the mining of iron ore has been increased, new production capacities have been brought into action.

Due to the further strengthening of leadership from the Soviet, Party, and Trade Union Organs,the metallurgical concerns have considerably overfulfilled the demands of the economic plan and the control figures for the 7-Year Plan.

In two years the metallurgists have produced an excess of 800 thousand tons of iron, more than 5 million tons of steel, about 4 million tons of rolled stock, 340 thousand tons of steel pipe, about 6 million tons of iron ore. The steel production compared with 1958 has increased by 10 million tons, rolled stock by about 8 million tons. This increase in our metallurgy has never been known before.

In 1960 in the metallurgical industry, 84 very important industrial units were built and put into operation: at the Magnitogorsk Metallurgical Combine,two powerful open-hearth furnaces and a 2500 continuous strip mill; at the Kuznetsk Metallurgical Combine,a blast furnace and coke oven; at the Orsko-Khalilov Combine,an open-hearth furnace and a 2500 strip mill; at the Zhdanov Il'ich Plant the steel sheet production capacity has been increased by a third and the production of cold-rolled transformer steel has been increased by 114%.

Owing to checking and mobilization based on vigorous Socialist competition among the workers on new buildings, political education among them,and cooperation in the punctual delivery of equipment and materials, many new buildings have been finished ahead of time, including: the blast furnace at the Alchev Metallurgical Plant, two large-capacity open-hearth furnaces and a 1700 mill at the Cherepovetsk Plant, the first line of the 2500 rolling mill at the Magnitogorsk Combine, etc.

In the current year in ferrous metallurgy there are plans for the building of more than 100 important units, including: 5 blast furnaces and 17 open-hearth furnaces, 11 rolling mills, 12 pipe mills,and 20 iron ore plants.

One of the most important factors in fulfilling and overfulfilling the production plan is to increase labor productivity. The trade union organizations of the metallurgical plants therefore pay serious attention to this.

Special mention should be made of the work of trade union organizations at the Nizhnii Tagil Metallurgical Combine and the "Zaporozhstal'" Plant.

The plant committee of the union together with the administration of the Combine have made every effort to organize the collective to achieve high indices in the utilization of metallurgical units.

At each unit, in each brigade, shift,and department,comprehensive plans were developed to increase the production with the existing capacities.

An accurate calculation of efficiency from introducing intended measures serves as an economic base for actual socialist measures to be taken by the collectives.

On the basis of measures proposed by the comprehensive plan, the team led by steel smelter A. D. Morogov in 1959 achieved a production of 10.83 tons of steel from 1 m^2 of furnace hearth area – the highest index at that time for the utilization of single-type units in the country.

For his outstanding achievement A. D. Morogov was made a Hero of Socialist Labor. At this Combine the collective of communist labor of the open hearth furnace, led by steel smelters Yu. M. Zashlyapin, Yu. P. Ploskonenko, N. M Kal'nichenko, and T. Ya. Obraztsov took upon themselves the task of producing in 1963 the production level which had been planned for the end of the 7-Year Plan – 12 tons of steel from 1 m^2 of hearth area. By 1960 the innovators had achieved a production of 11.36 tons and smelted at their unit 323 thousand tons of steel, giving the national economy 10 thousand tons of metal in excess of the plan.

Metallurgists of the "Zaporozhstal'" Plant have been very successful. The plant collective has fulfilled its socialist duties before the expected time, and in two years, without introducing new production capacity, they have increased the iron smelting by 14.1%, steel by 15.1%, and rolled stock by 17.7%. There has been a sharp increase in the production of thin steel sheet, especially of stainless and transformer steel. The gross production was increased by 27.5% and the labor productivity increased by 20.5%.

The steel smelters have been particularly successful, achieving high technical and economic indices.

The production of steel from 1 m^2 of furnace hearth area, on the whole, throughout the department in 1960 was 10.25 tons compared with 9.16 tons in 1958; the weight of the heat during this period was increased by almost 20 tons and the time for the heat was reduced from 8.24 to 7.9 hours. The successes of the "Zaporozhstal'" metallurgists would have been impossible without considerable organization by the plant and department committees of the Trade Union and the management of the plant on the mobilization of the collective for the early fulfilling of the 7-Year Plan.

However, some factories were behind in fulfilling the State Plan in 1960 and deprived the national economy of a large amount of metal.

Thus, in 1960, 8 factories did not fulfill the plans for the smelting of iron, 5 were behind on steel, 4 on the production of rolled stock, and 3 on the production of steel pipes.

In 1960 these plants deprived the country of: 314 thousand tons of iron, 216 thousand tons of steel, 266 thousand tons of rolled stock, and 135 thousand tons of steel pipes.

The last year's operation was unsatisfactory at the Orsko-Khalilov Metallurgical Combine, the Chusovsk, Alchev, and Krivoi Rog Metallurgical Plants.

For example, the Orsko-Khalilov Metallurgical Combine in 1960 was short of tens of thousand of tons of ore, steel, and other production, did not fulfill the plan to reduce production costs, and overspent almost 67 million rubles; the losses from rejects were about 12 million rubles. Due to unsatisfactory labor and production discipline the losses in working time were about 38 thousand working hours.

The main reason for the poor operation of the combine is the extremely unsatisfactory organization of labor and production.

However, neither the management nor the trade union group at the combine have taken the necessary measures to eliminate the factors interfering with normal operation. The Orenburg Regional Committee of the trade union was also behind, although in the resolution of the presidium of the Central Committee of the trade union on July 12, 1960, attention of the Regional Committee of the trade union and the head of the administration of the metallurgical industry of the Council of National Economy, Comrade Kirillov, was drawn to a number of faults in the operation of the combine.

Some plants, although they fulfilled the plan, did not fulfill the socialist tasks which they had undertaken.

For example, the collective of the Chelyabinsk Metallurgical Plant in 1960 undertook to overfulfill the plan by 15 thousand tons of iron, 20 thousand tons of steel, 15 thousand tons of rolled stock; in reality the metal produced was much less than this.

At this plant they had poorly organized competition for reducing the cost of production and for increasing its quality and the productivity of the metallurgical units. Thus, in the last year the production costs rose against the plan by 28 million rubles (in old prices), the lost time of the open hearth furnaces for repairs has reached 14% (the plan stipulates 10%). In the last year the losses due to rejects were more than 27 million rubles.

The trade union and management leaders at the plant do not give the necessary help to the workers in fulfilling socialist obligations and permit formalism in competition. For example, at all of the open-hearth furnaces they have made a standard undertaking to "achieve a furnace campaign of 750 heats" whereas the collective of the No. 3 furnace in 1960 achieved a furnace campaign of 853 heats; in the No. 2 open-hearth furnace in all resolutions, the team of steel smelters has promised to "reduce rejects to 0.15%" whereas some teams have already reduced rejects to 0.05%.

The collective of the Kuznetsk Metallurgical Combine in March of last year made a valuable suggestion in the pages of the Central Press: to intensify competition for the exonomic use of iron, ferroalloys, metallic charge, and steel for each ton of finished rolled stock and in this way to save 8000 tons of charge, reduce the consumption of ingots per ton of finished rolled stock, and hence produce thousands of tons of finished rolled stock in excess of the plan in 1960.

The Central Committee of the Communist Party of the Soviet Union rated this initiative of the collective highly and remarked that it is of considerable economic importance and deserves every support. Many trade union committees together with management leaders have developed concrete measures and have achieved distinct successes in ferrous metal economy.

However, the managers of the Kuznetsk Metallurgical Combine have contented themselves with making promises. They have not explained to the workers the considerable economic importance of ferrous metal economies, they have done practically nothing to mobilize the collective to fulfill the promises they have made.

The result has been that in the last year at the Combine instead of saving 8 thousand tons of metal charge as they intended, they have overconsumed it to the extent of 7 thousand tons. The responsibility for failure to fulfill resolutions rests on the managers of the Kuznetsk Combine, the Kemerovsk Regional Committee of the trade union, and the management of the metallurgical industry Council of National Economy.

The Dnepropetrovsk regional committee of the trade union and the branch management of the Council of National Economy have also failed to support socialist resolutions with the necessary organizational measures. This is one of the main reasons for not fulfilling socialist resolutions at the metallurgical plants as a whole in 1959 and 1960. In these two years the metallurgical plants of the Dnepropetrovsk Council of National Economy underproduced to the extent of 170 thousand tons of iron, more than 140 thousand tons of steel, and 170 thousand tons of rolled stock.

In 1961, according to the plan, workers in ferrous metallurgy should produce 51.2 million tons of iron, 71.3 million tons of steel, and 55.3 million tons of rolled stock.

The collectives of the ferrous metallurgy plants have extensively developed socialist competition for the early fulfillment of the plan for the third year of the 7-Year Plan.

The task of workers in industry and mainly in heavy industry is not only to fulfill and overfulfill the requirements of the 7-Year Plan, but also to find possibilities for achieving the stipulated level of production and increase in production capacities with the least expenditure in money and materials.

The experience of leading collectives shows that this is quite possible.

Very effective measures which can result in production increases with the least costs are the increase in volume, capacity, and hourly productivity of existing metallurgical units.

Thus, at the Chusovsk Metallurgical Plant in 1960 during the general overhaul of the blast furnace its volume was considerably increased. As a result the furnace productivity increased by many thousands of tons of iron and the capital expenditures were only 1.8 million rubles, which is much less than in the building of new furnaces. Similar work was carried out at the Nizhnii Tagil Metallurgical Combine, Stalino, Enakievsk and some other metallurgical plants.

The collective of the "Azovstal'" Plant has shown valuable initiative in redesigning the No. 5 open-hearth furnace with an expansion of the hearth area and its conversion to firing by cold natural gas. As a result, the furnace productivity has been increased by 50 thousand tons per year, or by 20%. Work on the redesigning of the furnace was carried out during the general overhaul.

At the "Zaporozhstal'" Plant, by redesigning the slabbing mill and sheet mills their productivity has been almost doubled. The expenditure per ton of obtained increase in rolled stock production was much less than in the construction of similar mills at a new plant. At the Pervourals new pipe plant, arranging 3 annealing furnaces in the ball bearing pipe department and 2 furnaces in the wire drawing department with an expenditure of not much more than 140 thousand rubles has considerably increased the output of ball bearings and boiler pipes.

A large reserve for increasing metal production is further improvement in the use of existing units. At the same plant single-type units operating under the same conditions have different operating indices. Thus, in 1960 at the Magnitogorsk Metallurgical Combine the coefficient of utilization of useful volume of one blast furnace was 0.517, and that of a second was 0.640; at the Nizhnii Tagil Metallurgical Combine the figures were 0.684 and 0.759; at the Krivoi Rog Plant they were 0.744 and 0.851; etc.

Calculations clearly show that if every metallurgical plant could achieve the same results at all blast furnaces as those obtained at the best furnaces of these plants (i.e., if the achievements of the leading furnaces were made a standard for all), the smelting of iron in this country would increase by 1-1.5 million tons per year without any capital expenses.

Blast furnace workers at the Cherepovetsk Metallurgical Plant, using advanced techniques, high gas pressure at the throat and hot blast, are operating their furnaces almost 30% better than the average for the country. In the second year of the 7-Year Plan they reached a coefficient of utilization of useful volume of 0.579 and a minimum consumption of coke (586 kg/ton iron), overtaking the blast furnace workers of the Magnetogorsk and Kuznetsk Combines. The Cherepovetsk blast furnace workers have promised to raise the coefficient of utilization of useful volume in 1961 to 0.54 and to give tens of thousands of tons of iron in excess of the plan.

There are also large unused reserves in open-hearth production.

In 1959 steel smelters of the "Zaporozhstal'" Plant, comrades Zalozh, Gubar', Shestakov, and Moiseenko smelted in the 185-ton open hearth furnace a world record amount of steel of 237 thousand tons and in 1960 the steel smelters of this plant, N. Grisenok, V. Zinov'ev, V. Kolyko, and A. Yakovlev, set up a new record: at the same furnace they smelted more than 250 thousand tons of steel.

By using oxygen and natural gas, increasing the weight of the heat and reducing lost time, by extending leading experience, the annual output of the 185-ton open-hearth furnaces of the "Zaporozhstal'" Plant are almost 32% higher than for similar furnaces of the Dzerzhinsk, Makeev, Chelyabinsk and other plants.

In the past year, teams of steel smelters of the second open-hearth department of the Magnitogorsk Metallurgical Combine, comrades Pryanikov, Makagonov, Kokosov, and Lychak, have increased the annual smelting of steel to 277.5 thousand tons by reducing the time for the heats, reducing lost time on repairs, and increasing the furnace campaigns.

If all steel smelters of the Magnitogorsk Combine working on the same types of furnaces gave this productivity, it would be possible to provide the country with an additional 250 thousand tons of steel per year.

One of the most important means of increasing metal production is socialist competition. At many plants competition in communist labor has taken on a truly mass character.

Socialist competition between plants is very valuable in studying and extending the leading production experience. This is confirmed by the many years competition between the workers at Magnitogorsk and Kuznetsk, the collectives of the "Serp i Molot" Plant and the "Krasnyi Oktyabr" Plant.

In their efforts to fulfill the resolutions of the 22nd Conference of the Communist Party of the Soviet Union, the collectives of the ferrous metallurgy plants, bearing in mind the existing reserves and possibilities, have taken on themselves increased socialist responsibilities for the early fulfillment of production plans, improving technical and economic indices, increasing productivity, lowering production costs, economizing in raw material, materials and electrical power.

The metallurgists of Magnitka have promised in 1961 to produce in excess of the state plan 25 thousand tons of iron, 60 thousand tons of steel, 40 thousand tons of rolled stock, 45 thousand tons of sinter, and 55 thousand tons of iron ore.

The steel smelters of the No. 2 open-hearth department of the Magnitogorsk Metallurgical Combine have become initiators of socialist competition in that they have made the record production of leading units a standard for operation of all collectives. This initiative has been warmly supported by the collectives in all departments of the combine.

However, the results of operation in the metallurgical industry during January and February of this year show that some plants are not only not fulfilling the promises made to the 22nd Conference of the Communist Party of the Soviet Union, but also the state plan. In the smelting of iron, 8 plants have not fulfilled the plan, including YuGOK, Alchev, Makeev, Chelyabinsk and other metallurgical plants.

The trade union and management organizations in ferrous metallurgy should use every effort to mobilize the workers in their efforts for an early fulfillment of the production plan of the third year of the 7-Year Plan and in meeting the resolutions of the 22nd Conference of the Communist Party of the Soviet Union.

There should be improvements in the management of socialist competition and the movement for communist labor, and also the organization of labor and production, work should be intensified on the extension and reconstruction of existing plants, the modernization of equipment, and the improvement of processes; the maximum use must be made of internal reserves.

There must be strict control on the fulfilling of promises, in the introduction of recommendations made at branch meetings and technical conferences.

The trade union organizations should take measures to improve the activity of the NTO, the work of organizations of the Society of Inventors and Rationalizers, and in the honor of the 22nd Conference of the Party there should be public examination of the production reserves and also the suggestions and inventions of development workers should be collected.

The Soviet metallurgists are resolutely working to fulfill the great and noble task set before them by the Party and the Government, inspired by the single desire to give the country more metal, and by new labor achievements to meet the resolutions of the 22nd Conference of the Party.

THE EFFECT OF MATERIAL TRANSFER ON THE CHANGE IN SIEVE COMPOSITION OF SINTER

L. M. Rudakov and I. I. Gorshtein

Head of the Sintering Group of the Central Laboratory of the Alchev Metallurgical Plant,
Voroshilov Mining and Metallurgy Institute
Translated from Metallurg No. 4, pp. 4-6, April, 1961

The sintering section of the Alchev Plant, built to the standard design of the "Mekhanobr" Institute, started operation in November-December, 1959, the sintering machines each having 75 m^2 sintering area. Since March, 1960, the section has been producing fluxed sinter of basicity 0.8-0.9.

The chemical and physical characteristics of the charge components are given in Tables 1 and 2.

Before loading into the cars, the sinter from the machine is transported by belt conveyers. In this run there are five transfer points with a total height of fall of 22 m (Fig. 1).

TABLE 1

Chemical Characteristics of Charge Components

Component	Content, %						
	Fe	FeO	i.r.*	CaO	ash	C	H_2O
Concentrate KMA	58.8	24.1	15.0	1.2	—	—	10.0
Sintering ore:							
Dzerzhinskii mine	52.9	0.9	20.1	0.5	—	—	5.3
Komintern mine	60.5	1.0	12.0	0.5	—	—	4.2
KMA	57.8	16.9	5.7	1.3	—	—	7.8
Blast furnace dust	35.5	11.6	18.3	10.8	—	11.0	—
Limestone	—	—	1.6	53.0	—	—	1.5
Coke fines	—	—	—	—	13.7	—	8.3

* i. r. — insoluble residue.

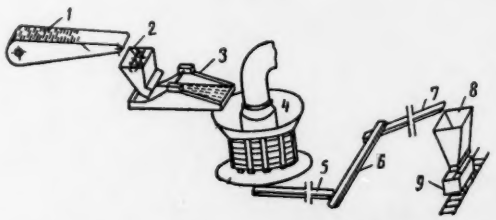


Fig. 1. Route of sinter: 1) sintering machine; 2) single-roll crusher; 3) self-balancing screen; 4) bowl cooler; 5) A-5 conveyer; 6) P7-1 conveyer; 7) BA-1 conveyer; 8) sinter bin; 9) rail car.

To study the change in sieve composition of the sinter due to transfers and additional cooling with water after the bowl coolers, for 8 days 500-600 kg samples of sinter were taken after the self-balancing screen, from the knife of the bowl coolers, from the belt conveyers P7-1 and BA-1, and from their cars.

The samples were selected so that they all came from one batch of sinter along its path of movement.

The quality of the sinter in the period of investigation is shown in Fig. 2.

The sinter, after crushing in a single-roll crusher, is taken to the self-balancing screen arranged in front of the bowl cooler. The yield of recovery is 25-30%; the mean sieve composition of the hot return material is characterized by the following data:

Fractions, mm	10—8	8—5	5—3	3—0
Content, %	7.4	38.9	27.7	26.0

The sieve composition of the sinter after screening is

Fractions, mm	+12	12—5	5—0
Content, %	88.0	8.5	3.5

These data show that the sinter after screening is sufficiently lumpy. However, later, after passing through the bowl cooler and repeated transfers, the sinter is strongly reduced in size.

TABLE 2

Sieve Composition of Materials, %

Material	Fractions, mm		
	+5	5—3	3—0
Charge	16.7	16.3	67.0
Limestone	0.2	4.4	95.4
Coke fines	—	6.6	93.4

In the bowl coolers of diameter 8.0 m the sinter is cooled by the forced drawing of air through the sinter bed. The air flow for the cooling is 1500 to 1800 m^3 per ton of sinter. According to the planning data the sinter should be cooled to temperatures of 90-100°; however, due to the design faults in the bowl cooler the temperature is only reduced to 150-200°

The sieve composition of the sinter after the bowl cooler is:

Fractions, mm	+12	12—5	5—0
Content, %	74.6	16.9	8.5

From the bowl cooler the sinter is removed by a knife onto the belt conveyer A-5, transferring it to the conveyer P7-1 on which the sinter is sprayed with water for further cooling. The drop in height from the cooler to the A-5 conveyer and then to the P7-1 is 3 m. The sieve composition of the sinter after spraying with water and two transfers is as follows:

Fractions, mm	+12	12—5	5—0
Content, %	66.0	20.8	12.2

After transferring to the BA-1 conveyer with a 6 m height of fall, the sinter is further broken down and has the following sieve composition:

Fractions, mm	+12	12—5	5—0
Content, %	57.9	25.5	16.6

The BA-1 belt conveyer transfers the sinter to the loading bin. As the bin is filled the sinter is fed into the cars by a drum feeder. At this section there is a double fall with a total height of fall of 11 m. The sieve composition of the sinter from the car is:

Fractions, mm	+12	12—5	5—0
Content, %	48.8	29.8	21.4

The change in the sieve composition of the sinter due to all transfers is shown in Fig. 3.

The data of the investigation show that at the section of the self-balancing screen and bowl cooler the quantity of fines (0-5 mm) is increased by 5.0%, which is due to the rubbing of the sinter in the bowl cooler and to it being broken up by the knife.

A large quantity of fines is formed on the conveyer belts due to many falls and to the sinter being sprayed with water. The sinter is especially strongly broken up at the section of the belt conveyer BA-1 and the car due to the steep fall.

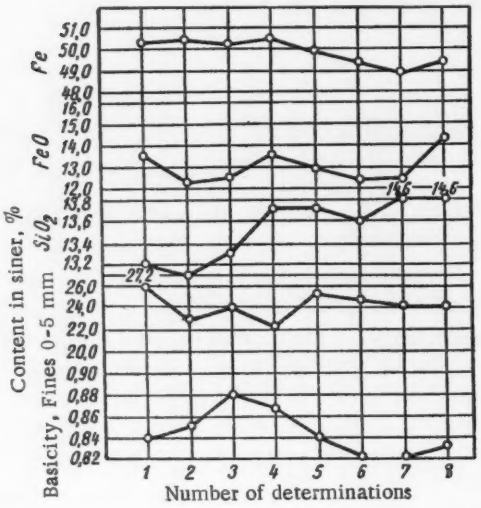


Fig. 2. Quality of sinter during period of investigation.

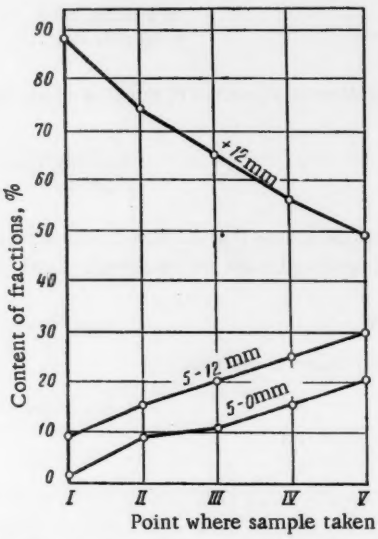


Fig. 3. Change in sieve composition of sinter: I) self-balancing screens; II) bowl cooler; III) P7-1 transporter; IV) the same, BA-1; V) rail car.

The sieve composition of the sinter in the blast furnace bins is characterized by the following data:

Fractions, mm	+12	12—5	5—0
Content, %	35.0	40.2	24.8

These data show that,due to design faults in the sinter transport route,the lumpiness of the sinter deteriorates considerably and the content of 5-0 mm fines in it increases 7-fold compared with the initial value.

To improve the sinter quality it is essential to redesign the sinter transport route, reduce the number of transfers,and keep the drop in height to a minimum.

There should also be double stage screening of the sinter with separation of the hot sinter on the stationary screen and cooling (after the coolers) on the self-balancing screens.

THE OPTIMUM COMPOSITION OF BLAST-FURNACE SLAG AT THE SOUTHERN PLANTS

N. N. Chernov and A. N. Chechuro

Dneprodzerzhinskii Metallurgical Institute, Dzherzhinskii Plant
Translated from Metallurg No. 4, pp. 6-8, April, 1961

The optimum slag system is determined by lengthy production tests. During the operation of a blast furnace there are considerable deviations in the chemical analysis of slags due to lack of constancy in the raw material composition and also due to the varying consumption of ordinary and dolomitized limestone in the charge. It is therefore very important to select a slag in which even large changes in the composition will not involve difficulties in working with it. It should withstand unavoidable variations in the composition without noticeable changes in properties and characteristics.

Slag whose quality is considerably affected by small changes in the chemical composition of the raw material can partially lose its ability to remove sulfur. This fact causes the operators to reduce the ore charge in order to extend the heat boundaries; this leads to a reduction in productivity and an increase in coke consumption.

At the Dzerzhinskii Plant blast-furnace department, the slag system was considerably changed twice; the first time on changing over to smelting of low-manganese iron and the second time in connection with the use of natural gas and oxygen.

TABLE 1

The Mean Chemical Analysis of Slag at Different Periods of Operation in the Department, %

Components	Composition of slag before smelting low-manganese iron	Composition of slag on smelting low-manganese iron	Composition of slag on using natural gas and oxygen
SiO_2	40.9	37.2	38.8
Al_2O_3	5.5	5.5	5.7
CaO	43.4	49.0	48.9
MgO	1.96	5.16	4.2
MnO	5.86	0.75	0.52
FeO	0.75	0.43	0.35
S	1.6	1.82	1.52

On the changeover to the smelting of low-manganese iron the slag basicity (the ratio $CaO:SiO_2$) was raised from 1.06 to 1.32 (Table 1). The content of magnesium increased from 1.96 to 5.16% and manganese oxide was reduced from 5.86 to 0.75%. The reduction in the consumption of manganese ore led to a reduction in the slag yield per ton of iron.

To prevent an increase in sulfur in the iron on reducing the amount of slag and a reduction in the desulfurizing action of manganese, as well as increasing the slag basicity, the heating of the iron had to be intensified. This, in its turn, reduced the ferrous oxide content in the slag from 0.75 to 0.43%.

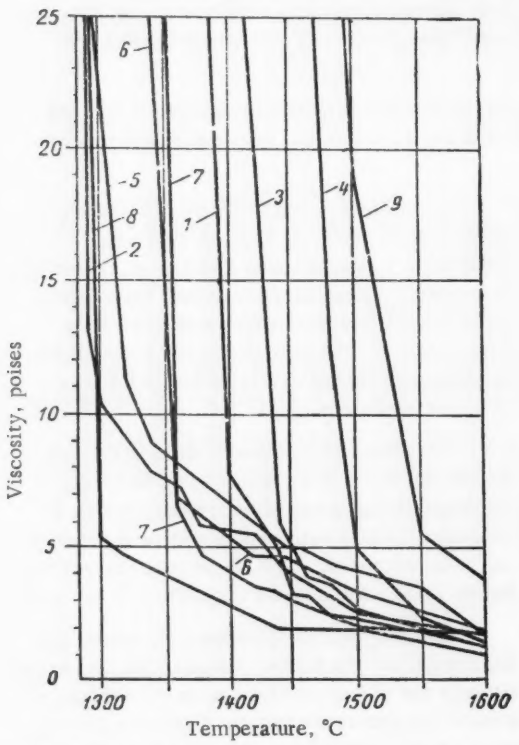
Changing over to operation with natural gas and oxygen led to a further change in the slag system, although not to such an extent as in the smelting of low-manganese iron. This is because the grade of smelted iron remained unchanged, and the changes in the slag composition were mainly due to reduction in the coke consumption, which resulted in a reduction in the sulfur introduced. This made it possible to work with more acid slags – the $CaO:SiO_2$ ratio was reduced from 1.32 to 1.24-1.26. There was a further reduction in the manganese oxide content from 0.75 to 0.52%; the content of alumina and ferrous oxide remained about the same.

However, the chosen slag was still far from the optimum, which was shown by the experiments. It was decided to check the viscosity of the slags which are usually encountered in blast furnace operation when smelting low-manganese irons. The chemical compositions of nine tested slags are given below, in %:

Slag	SiO_2	Al_2O_3	CaO	MgO	MnO	FeO	S	$\frac{CaO+MgO}{SiO_2}$
1	38.3	6.17	47.56	5.27	0.53	0.39	1.79	1.38
2	40.0	6.17	45.85	5.27	0.53	0.39	1.79	1.28
3	36.5	6.17	49.35	5.27	0.53	0.39	1.79	1.5
4	35.85	6.17	46.0	5.27	0.53	0.39	1.79	1.43
5	39.85	6.17	46.0	5.27	0.53	0.39	1.79	1.29
6	37.38	8.0	46.64	5.27	0.53	0.39	1.79	1.39
7	38.64	5.5	47.88	5.27	0.53	0.39	1.79	1.41
8	38.3	6.17	44.82	8.0	0.53	0.39	1.79	1.38
9	38.3	6.17	49.82	3.0	0.53	0.39	1.79	1.38

The results of the experiments are shown in the figure. The greatest stability is shown by slag No. 8: at a temperature of 1300° it has a viscosity of about 5 poises, whereas slag No. 2 at this temperature has a viscosity of more than 10 poises, and the rest are practically nonflowing. In order to give the No. 9 slag a viscosity of 5 poises it must be heated to 1570°, i.e., 270° higher than the No. 8 slag.

In order that the blast-furnace slag should have maximum efficiency in its properties and be convenient for operation, it should be completely liquid. Under the conditions of the Dzerzhinskii Plant the slag temperature in the furnace is about 1500°. Consequently, the most effective of all the investigated slags will be No. 8, which at 1300° has a viscosity which allows it to run freely from the furnace.



Curves for the viscosity of blast-furnace slags: 1-9) number of tested slags.

The good properties of the No. 8 slag are due to the high (compared with other slags) content of magnesium (8% compared with 5.27). The No. 8 and 9 slags have the same basicity $\frac{CaO+MgO}{SiO_2}$ – 1.38; however, the No. 9 slag is less stable: with a 70° reduction in temperature it is no longer able to flow freely from the furnace. On the other hand, this reduction in temperature has no effect on the mobility of the No. 8 slag. Consequently, slags with a high content of magnesium with the same basicity have less viscosity. Furthermore, the region of minimum values of viscosity is considerably extended.

With a high content of MgO in the blast-furnace slag, large fluctuations in charge compositions will not lead to a sudden increase in viscosity, sometimes leading to disruption of the furnace operation. The beneficial effect of magnesium is particularly noticeable in those slags which are not diluted with manganese oxide. The blast furnaces of the southern plants, smelting low-manganese iron, contain a small amount of manganese oxide (0.45-0.55%), and the content of MgO in the slag should therefore be increased. However, there is a limit beyond which the viscosity begins to increase sharply with increase in the magnesium content.

The most suitable composition of slag with optimum magnesium content should therefore be chosen. For southern blast furnaces smelting low-manganese iron this slag will presumably have the following composition, %:

SiO_2	Al_2O_3	CaO	MgO
36	5	43	16

This slag has good desulfurizing capacity and at the same time has a minimum viscosity, which is a favorable combination.

TABLE 2

Content of Magnesium in Magnitogorsk Blast Furnaces

Furnaces	Years				
	1955	1956	1957	1958	1959
1	7.2	7.9	8.6	8.55	8.86
2	6.69	7.61	8.14	8.48	8.86
3	7.05	7.75	8.02	8.73	8.72
4	6.92	7.62	8.2	8.41	8.71

The blast-furnace engineers of the Magnitogorsk Metallurgical Combine have long since started gradually increasing the magnesium content in the slag; the start of this was the conversion to the smelting of low-manganese iron.

Table 2 shows the content of MgO in slag for various years at some blast furnaces in the Magnitogorsk Metallurgical Combine. In this slag there is about three times as much alumina as in the slag of the Dzerzhinskii blast furnaces; it should therefore have less MgO than in the slag where the content of alumina is lower. Nevertheless, the blast-furnace engineers of the Magnitogorsk Combine have daringly continued to increase the magnesium content in the slag to reduce its viscosity and improve its desulfurizing capacity. There is already experience in operating with slags containing 12% MgO.

With a shortage of dolomitized limestone at the southern metallurgical plants, the real optimum may be a slag with 7.5-8% magnesium.

IN THE BLAST-FURNACE DEPARTMENT OF THE MAGNITOGORSK METALLURGICAL COMBINE

V. P. Emel'yanov

Magnitogorsk Metallurgical Combine
Translated from Metallurg No. 4, pp. 8-10, April, 1961

The Control Assembly of Carbon Blocks before Lining in the Bottom of the Furnace

During a general overhaul of a blast furnace the carbon blocks for the bottom are laid without preliminary adjustment of the elements; they are selected by sizes and adjusted on the spot. The laying of blocks was therefore carried out in one direction with unavoidable holdups due to adjustment. This requires a high degree of skill on the part of the assembly worker and takes up much time.

To improve the labor conditions and speed up the process of laying carbon blocks on the bottom of the Magnitogorsk blast furnaces, a suggestion has been put forward by M. T. Livenskii, Kh. I. Akhmetzyanov, M. V. Yakhontov, and P. P. Mishin that before the furnace overhaul there be control assembly of the blocks on special stands outside the blast furnaces with adjustment of the elements. The blocks are laid out on a stand, the joints adjusted, and the elements marked in the order in which they will be used in the repair. This method eliminates the adjustment of the elements during the repair.

The accuracy and speed of laying blocks depend on the organization of the feeding of elements into the furnace. Because of the marking the laying can be carried out in two directions by two teams, starting from the

central strip of blocks. The mechanization of block delivery has been used with great success. The economy resulting from this suggestion is about 40 thousand rubles per year.

The stand for the control assembly of the blocks is assembled from separate elements (a suggestion by M. V. Mordukhovich). The elements of the stand (Fig. 1) are prepared from angle iron and sheet metal by electric welding. During the general overhauls, the welded elements are connected together by bolts and fastened to the central welded pit.

After use, the stand is dismantled and stored in a certain place at the railway line so that during the next repair of the blast furnace it can be loaded onto the railway platforms and transferred to the required place.

Redesigning the Vibrating Screen Shock Absorbers

The shock absorbers on the vibrating screens used in the blast-furnace department for screening the coke were in the form of springs of diameter 80 mm, made from 18 mm bars. The springs were in special housings and were suspended from the bins on 17 mm diameter cables.

During operation due to overloading of the screens the cables often were at the points where they made contact with the housings and the springs broke, leading to holdups and disturbances in the charging cycle of the blast furnaces. In one year about 400 springs failed; it took two fitters about 20 minutes to replace each of them.

To reduce the holdups connected with the replacement of broken springs and reduce the consumption in their manufacture of the Magnitogorsk Metallurgical Combine, a suggestion has been made by P. I. Kasukhin to change the design of the fastening and increase the dimensions of the springs. The flexible (on cables) connection between the shock absorber and the bin has been replaced by rigid suspensions made from a round blank of 30 mm diameter. More powerful springs were used – of 130 mm diameter from 24 mm bars. With the installation of rigid suspensions it was no longer necessary to have housings, which considerably reduced the expenses in the manufacture of shock absorbers. Due to the change in design of the shock absorbers the consumption of springs has been reduced to a fifth and the time for replacement has been reduced to 5-7 minutes.

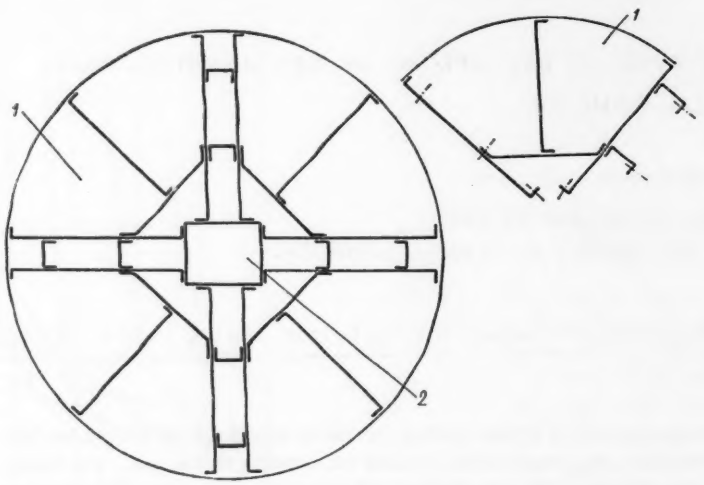


Fig. 1. Stand for assembly of carbon blocks: 1) element of stand; 2) frame.

Diabase Protection of the Walls of the Coke Hoppers of Scale Cars

The coke weighing hoppers on the blast-furnace-department scale cars wear out rapidly, and to protect the walls from abrasion 12-mm armor plates are used. However, even armor plates which are faced with stalinite last no more than 4 months, after which they have to be dismantled; this requires the expenditure of much working time and materials.

To lengthen the life of the weighing hoppers and to reduce the expenses on repairs at the Magnitogorsk Metallurgical Combine, D. S. Gormakov has suggested that the sloping walls of the weighing hoppers be lined

with diabase plates instead of armor plate. The plates are placed on edge so that the thickness of the coating is about 120 mm. To maintain the volume the hoppers are lowered 200 mm down and the volume is maintained due to the restoration of the walls to the previous height. The straight walls of the hoppers are protected as before by armor plate, since at these sections the wear is very small. The life of a coating of diabase plates is 8-10 years.

The introduction of this suggestion in the blast furnace department of the Magnitogorsk Metallurgical Combine has resulted in about 3500 rubles economy.

Loudspeaker Communication in Blast-Furnace Repairs

During blast-furnace repairs it is essential to remove from the charging floor a large amount of dismantled worn equipment and install new equipment in its place.

The workers engaged in raising and lowering the loads usually communicate with one another by gestures. Due to the distance and the poor visibility (the visibility is poor due to the numerous metal structures and equipment in the path of the loads), this type of communication is very inconvenient, especially at night time.

To provide safe working conditions during raising and lowering the loads in blast furnace repairs, A. S. Cheburin at the Magnitogorsk Metallurgical Combine has suggested the installation of loudspeaker communication between the charging floor and the factory floor; in this way a team of assembly workers working at great distances from one another can be safe.

A. F. Kharkin has suggested replacing the wooden insulators by porcelain insulators. This has facilitated work on the servicing of trolleys and cranes.

Coolers with Assembly Hooks

The coolers of the bottom cylindrical portion and the bosh of blast furnaces are installed and removed during repairs with great difficulty, since they are very heavy and large. In the changeover much time is spent in securing the cooler with the cable.

To reduce the operations in installing coolers at the Magnitogorsk blast furnaces a suggestion has been made by M. V. Yakhontov, V. A. Lednov, and T. Kh. Valeev that assembly hooks be cast in the body of each cooler; this reduces the time to about a third for securing the coolers before installation in the furnace (Fig. 2). The hooks are made of 32 mm diameter steel bars.

Separating Valve for Switching the Gas during Repairs

Before repairs, a blast furnace must be disconnected from the gas purification. The disconnection is essential even during small repairs, for example when replacing the tuyeres. For this purpose "Kling" sliding-plate valves of diameter 1800 mm are used; these work very poorly, especially in the winter, and four workers have great difficulty in closing them in 5 minutes. With a large number of small repairs a large percentage of the lost time of blast furnaces is spent in closing the gate valves.

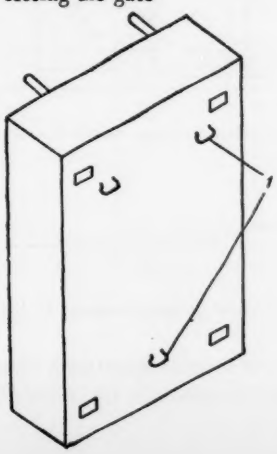


Fig. 2. Cooler with assembly hooks: 1) hooks.

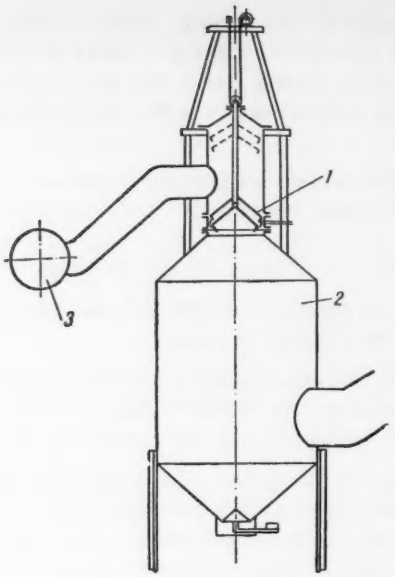


Fig. 3. Separating valve: 1) valve; 2) dust collector; 3) gas pipe for unpurified gas.

On the suggestion of V. A. Shastin and P. P. Mishin (Fig. 3), over the dust collectors before the collector of the unpurified gas, additional separating double-cone valves have been installed with steam filling (standard Gipromez valves). The valve has an electrical drive and is closed in 50 seconds, i.e., 6 times faster than the "Kling" gate valve. The valve is closed by one worker without difficulty.

With the installation of separating valves the "Kling" valves began to be used to stop the gas only during large-scale repairs: general overhauls and medium-scale repairs. In the other cases the "Kling" valves do not operate, which considerably increases their life. The introduction of this suggestion at only three furnaces of the combine has resulted in economies of about 7000 rubles per year due to the reduction in lost time.

AN ELECTRIC FURNACE WITH SLOPING WALLS AND SPLIT HOUSING

I. I. Kulakov

Senior Foreman of the Electric Steel Smelting Department of the Zlatoustovsk Metallurgical Plant

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The arc furnaces of the electric steel smelting department of our plant have a cylindrical housing and walls. The walls of the furnaces are lined with blocks prepared from a mixture of coarse magnesite powder and coal tar. The side of the block facing into the furnace is slightly inclined. The life of these walls was usually 50-55 heats.

During operation the walls crumbled and they had to be treated with a paste of magnesite powder and lime. For this reason the hot holdups of the furnace were increased. The furnaces were stopped for cold repairs twice and sometimes three times a month. Experience of the electric steel smelters of the Kuznetsk Metallurgical Combine, who increased the diameter of the furnaces, keeping the walls straight, led them to use unroasted magnesite chrome brick in boxes at one of the furnaces to increase the life of the walls.

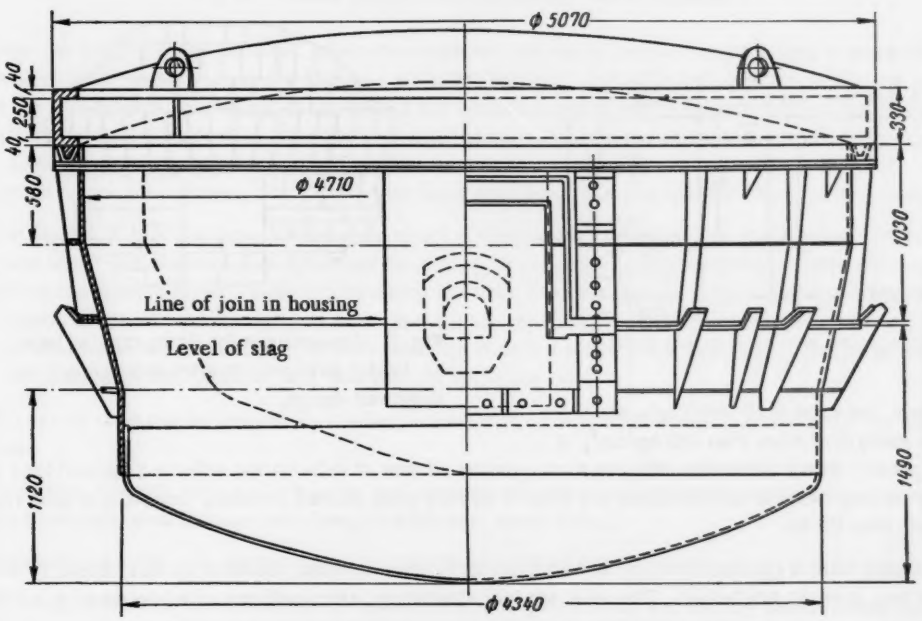


Fig. 1. Diagram of furnace housing with inclined walls.

A group of engineers at the Zlatoustovsk Metallurgical Plant have suggested redesigning the housing of one electric furnace, replacing the bottom cylindrical part at a height of 820 mm by a part at an angle of 30°. The

cylindrical part of the housing and the tapered part at a height of 450 mm were removable. The old bottom was used for the furnace housing (Fig. 1).

The diameter of the furnace in the upper part was increased by 350 mm. The rigidity of the cylindrical and tapered parts of the housing was provided by specially placed ribs – 16 vertical and 3 horizontal. The upper movable part was connected with the fixed part by flanges. The line of the join in the housing is 25 mm above the slag level. The life of the water-cooled arch of the charging door (Fig. 2) was 6-8 months.

The hearth and the slopes were laid in the usual way with MG-1 and MG-6 magnesite brick. The last row of width 450 mm should be higher than the line of join in the housing. The walls of the furnace are lined with unroasted magnesite chrome brick in boxes (produced by the refractory department of the Kuznetsk Metallurgical Combine). The walls were lined with 430 and 300 mm bricks. Three rows of the walls are laid with 430 mm brick and three with 300 mm brick. The gap between the brick and the housing of the furnace is filled with finely ground waste from the old roof brick. The life of the walls laid with this brick was 200 heats after the redesigning of the furnace housing. To increase the life the lining of the arch of the tapping hole (Fig. 3) was changed. The initial lining was not successful because the bricks spanning the hole and placed at the top chipped. Spanning the tapping hole with 300 mm brick in three rows in depth considerably increased the life of the hole and the back wall.

The lining of the furnace is shown in Fig. 4.

At the present time, due to the absence of brick in the boxes for lining the walls, KhM-1 magnesite chrome brick is used and KhM-3. According to its technical specifications this brick contains not more

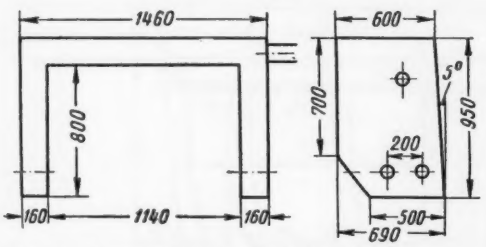


Fig. 2. Water-cooled arch of charging door.

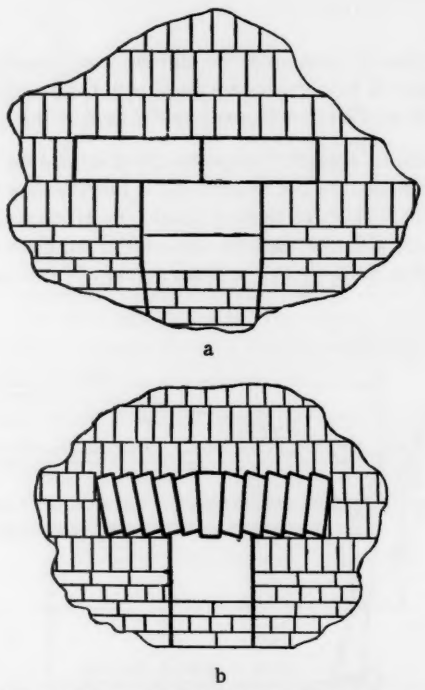


Fig. 3. Arrangement for lining tapping hole: a) initial arrangement after redesigning; b) improved design.

than 42% MgO, not more than 15% Cr_2O_3, and has a compressive strength of more than 250 kg/cm^2, a volumetric porosity of not more than 24%, and a temperature of start of deformation under a 2 kg/cm^2 load of 1450°. The binding material used in lining the walls is an acid paste diluted in water, consisting of sand (75%) and refractory clay (25%).

The tapping hole is spanned the same as in the lining by brick in boxes, differing in that instead of one row, two are laid both in depth and height. The walls are laid alternately, after each row of bricks on edge a row is laid flat.

The life of magnesite chrome brick walls with acid paste was (test carried out over three campaigns): I campaign) 170 heats, II) 213, and III) 267. The furnace was used to smelt ball bearing and alloy machine steel. After redesigning the furnace the life of walls made from blocks was increased from 55 to 85 heats.

The advantage of electric furnaces with a split housing over those with a stationary housing is not only that the life of the walls is increased,but the labor conditions during repairs are much facilitated. The main points in the organization of work during furnace repair are as follows.

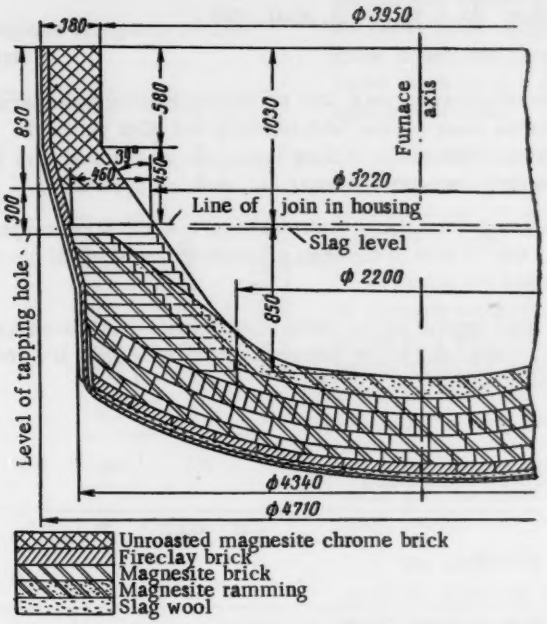


Fig. 4. Furnace lining. Section through working space.

After the tapping of the last heat, while the electrodes are being removed and the roof is taken off, the fitters remove the bolts connecting the flanges. A special fastening device is then used to transfer the cylindrical part and the part tapered to a height of 450 mm of the furnace together with the spent walls to the place where they are knocked out. The furnace wall lining is removed in 30-50 minutes instead of 4 hours as in the usual repair. After removing the housing and walls of the furnace the brickworkers remove slag from the slopes and if necessary the slopes are cracked. The bath is then freed from brick and slag and the lining of the slopes begun.

The dismantling of the furnace during the repair is considerably facilitated by the absence of a furnace housing and walls. After erection of the slopes the housing is put in place and the furnace walls are lined. Six men work on the furnace repair: three brickworkers and three from the furnace brigade. When the walls are lined with unroasted magnesite chrome brick in boxes,the furnace repair takes 10-12 hours; when KhM-1 and KhM-3 magnesite chrome bricks are used with an acid paste the time is 14-16 hours. The longer furnace repair time is simply due to the fact that in the second case smaller bricks are used.

The repair time can be reduced by another 2-3 hours if there is a spare wall housing which can be lined beforehand.

Therefore, furnaces with a split housing and sloping walls lined with magnesite chrome brick have considerable advantages over furnaces with straight walls with block lining.

Considerable economies were achieved by redesigning the electric furnaces.

At the present time three furnaces are operating with a split housing and sloping walls. Before long all furnaces of the department will be converted to split housings and sloping walls. This will considerably increase the steel production and reduce the steel costs.

THE QUALITY OF CONVERTER METAL

N. I. Beda and P. Ya. Ryzhkov

Petrovskii Plant

Translated from Metallurg No. 4, pp. 13-16, April, 1961

The industrial production of converter metal with top oxygen blowing was started at the Petrovskii Plant in October, 1956. In four years the plant, together with institutes and other plants, has made a wide variety of investigations into converter metal. The results of these investigations and tests have shown the complete equivalence in quality characteristics between converter and open-hearth steels.

As regards the gas content in the metal, converter steel is almost the same as open hearth. It can be seen from the data given in Table 1 that in most of the heats of converter metal (97%) the nitrogen content does not exceed 0.008%.

The nitrogen content in steel depends on the purity of the oxygen used. Investigations have shown that when using oxygen of industrial purity (99.2%) the nitrogen content in the steel is 0.0035%, and with 99.5% pure oxygen the nitrogen content can be reduced to 0.002%.

TABLE 1

Gas Content in Converter and Open-Hearth Steels

Steel	Profile	Gas content,* %			Place of analysis
		O_2	N_2	H_2	
KSt. 3kp	No. 20 beam	0.003–0.006 0.0046	0.0038–0.006 0.004	0.00015	Petrovskii Plant
MSt. 3kp	90 x 90 mm sheet bar No. 20 beam	0.006–0.020 0.0102	0.0045–0.0085 0.006	0.00019	The same
KSt. 10sp	90 mm circle	0.002–0.019 0.0035	0.005–0.008 0.007	0.00008	» »
MSt. 10sp	The same	0.002–0.014 0.0061	0.004–0.007 0.005	0.00023	» »
KSt. 25G2S	58 x 58 mm sheet bar	0.002–0.004 0.0035	0.007–0.0095 0.008	0.00028	» »
KSt. 62sp	Crane rails	0.001–0.006 0.0027	0.002–0.010 0.006	0.00020	» »
MSt. 62sp	The same	0.0021	0.007	—	Kuznetsk Combine
KSt. 3kp	20 mm sheet	0.006	0.006	—	Proektstal'konstruktsiya
MSt. 3kp	The same	0.009	0.006	—	The same
KSt. 3sp	" "	0.003	0.003	—	" "
KSt. 3kp	" "	0.0088	0.0044	—	Paton Electric Welding Institute
MSt. 3kp	" "	0.0070	0.0047	—	The same

* The mean gas content is given in the denominator of the fraction.

Under the conditions of the Petrovskii Plant, with an oxygen purity of 98-99% the metal of 30% of the heats has a nitrogen content of not more than 0.004%, and for open-hearth metal this nitrogen content is only given by 4.4% of the studied heats.

TABLE 2

Comparative Data on the Relative Elongation of Converter and Open-Hearth Metal

Relative elongation δ_{10}, %	K-3kp steel		M-3kp steel	
	number of heats	%	number of heats	%
22—23.9	15	3.57	35	4.7
24—25.9	22	5.23	98	13.3
26—27.9	61	14.5	159	21.7
28—29.9	85	20.1	181	24.6
30—31.9	120	28.5	166	22.6
32—33.9	64	15.2	69	9.4
34—35.9	37	8.8	19	2.6
36—37.9	16	3.8	8	1.0
38—39.9	1	0.3	1	0.1
Total	421	100	736	100

TABLE 3

Comparative Data on the Yield Point of Converter and Open-Hearth Metal

Yield point σ_s, kg/mm²	K-3kp steel		M-3kp steel	
	number of heats	%	number of heats	%
24	7	0.28	2	0.3
24—25.9	47	1.92	34	4.5
26—27.9	173	7.08	127	17.0
28—29.9	414	16.8	167	22.4
30—31.9	749	30.5	188	25.2
32—33.9	623	25.4	140	18.8
34—35.9	318	13.0	70	9.4
36—37.9	82	3.36	15	2.0
38—39.9	30	1.22	4	0.4
40—41.9	9	0.36	—	--
42	2	0.08	—	—
Total	2454	100	747	100

There is therefore a good chance of reducing the nitrogen content in converter metal by increasing the purity of the oxygen used. Depending on the grade of steel, the oxygen content in the converter metal varies but it is usually somewhat less than in open-hearth steel.

With regard to chemical composition, cast converter steel (both rimming and killed) meets all the appropriate All-Union State Standards for open-hearth steel.

During the introductory period in the smelting of converter metal the content of sulfur and phosphorus in it was somewhat higher than in the open-hearth metal; but later, by developing the method, it was possible to reduce the content of harmful impurities to their level in open-hearth steel.

The macro- and microstructure of converter metal does not differ from the structure of open-hearth metal.

The content of nonmetallic inclusions in converter metal was a little higher than in open-hearth metal up to 1959. After improving the method of smelting and casting converter steel and increasing the life of the converter lining, in 1959 converter metal became equal to open-hearth steel as regards its content of nonmetallic inclusions. As regards the mechanical properties (yield point, relative elongation), converter metal is again equal and in a number of cases better than open-hearth steels of corresponding grades (Tables 2 and 3). It has a somewhat higher impact toughness at different test temperatures. The values of impact toughness of specimens after artificial aging for both metals are practically the same.

The threshold of cold shortness of converter rimming and killed metal compared with open-hearth steel was studied on sheets of 12, 20, and 30 mm thickness in the state after rolling and determinations were made in the range of transition to the brittle state, which was established from the amount of brittle structure in fractures of impact specimens on reducing the test temperature.

The range of transition to the brittle state for St. 3kp and St. 3sp steels of the converter and open-hearth methods of smelting was correspondingly the same (Table 3); however, for killed steel it was displaced by 20-50° (depending on the thickness of the sheet) toward lower temperatures which, to the same degree, refers to metal of both smelting methods.

Numerous studies of converter and open-hearth metals for weldability showed good results.

In a report by the E. O. Paton Institute of Electric Welding in 1959, it was mentioned that the properties of welded joints made from experimental converter steel blown with oxygen and from MSt. 3kp ordinary open-hearth steel are equivalent.

For converter steel components the same methods of automatic and manual welding should be used and also the same filler materials as for components of MSt. 3kp steel. When testing with a variable load converter steel did not show increased sensitivity to the notch compared with MSt. 3kp open-hearth steel.

The endurance limits of flat welded specimens of converter steel with transverse seams and also with cover plates during symmetrical and sign-alternating cycles of stresses are not below those from MSt. 3kp open-hearth steel. The strength of welded joists of converter steel in tests with a varying load (symmetrical cycle of stresses) is almost the same as open-hearth steel.

Welded specimens of converter steel tested for resistance to repeated impact hardly differ from specimens of MSt. 3 steel. In tests with single impact at normal and low temperatures (to − 40°) no noticeable difference was found between specimens of converter and open-hearth rimming steel.

As a result of their investigations workers at the E. O. Paton Institute concluded that tested welded joints of converter steel are equivalent in their dynamic strength to joints from ordinary open-hearth rimming steel used for welded structures.

TABLE 4

Results for the Determination of Cold Shortness Threshold

Thickness of sheet, mm	Smelting method	Number of heats	Range of transition to brittle state, ° C			
			St. 3kp		St. 3sp	
			start	end	start	end
12	Converter	2	+100	− 5	+ 50	− 50
	Open-hearth	1	+100	−10	+ 50	− 50
20	Converter	2	+120	−10	+ 80	− 20
	Open-hearth	1	+100	−10	+ 80	− 20
30	Converter	+	+120	0	+100	− 20
	Open-hearth	1	+120	0	+ 80	− 20

Similar conclusions were drawn in tests for weldability of sheet rimming and killed metal in the Proektstal'-konstruktsiya Institute in 1960 and also at the Babushkin "Rostsel'mash" Plant, etc.

Experience in making wheel rims for the ZIL-164 (150) truck from KSt. 3kp converter steel using deep drawing gave good results in comparison with open-hearth steel; in an experimental batch the rim rejects due to cracks along the welded seam on stretching the rim were 0.87 and 0.71%, respectively.

The results of these investigations have shown the possibility of the widespread use of converter metal in industry.

* * *

Converter rimming and killed steel smelted with top oxygen blowing (oxygen purity 98-99%) is equivalent to open-hearth steel in its quality characteristics. Improvements in the smelting technique and increasing the oxygen purity to 99.5% and above will give a further increase in converter steel quality.

AT THE MAGNITOGORSK METALLURGICAL COMBINE

OPEN-HEARTH DEPARTMENT

Translated from Metallurg No. 4, pp. 16-18, April, 1961

Improving Units of Charging Machines

To reduce the holdups in charging machines due to broken axles and reduce consumption on the manufacture of spare parts in the open-hearth department, A. M. Naidenov and I. I. Shtopin have suggested a change in the design of the unit for holding the bearings (Fig. 1).

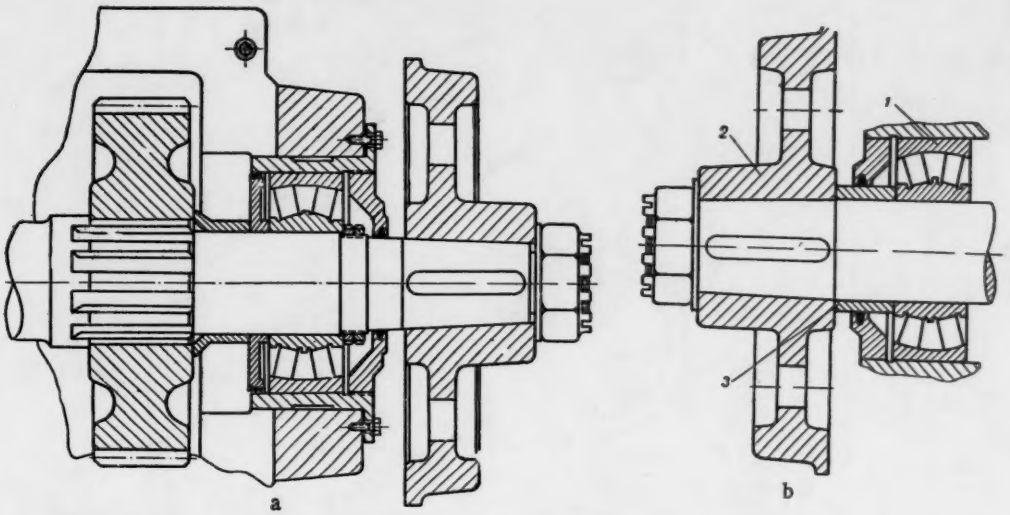


Fig. 1. Design of unit for fastening bearing: a) before redesigning; b) after redesigning ; 1) inner race of bearing; 2) sliding ring; 3) spacer bush.

The inner race of the bearing is pressed not by nuts,but by a sliding ring through a spacer bush. The strength of the axle is increased because it has no thread. The journals of the axle have one diameter without transitions, which not only increased the strength but also simplified the machining of the sliding ring axle.

With the introduction of the suggestion the life of sliding ring axles of charging machine trolleys was increased more than tenfold, giving considerable economies in the manufacture of spare parts alone.

On the suggestion of F. B. Losyakin,at the points of maximum wear on the end surfaces of the charging bar lock they have started to use hard facing. The thickness of the facing is 5 mm on a length of 70 mm from each end (Fig. 2). This increases the life of the lock by 1.5-2 fold.

With the implementation of this suggestion the consumption of spare parts has been reduced, giving definite economy.

A Tag for Fastening Devices

The tag tied to fastening chains, cables,and special weights giving the numbers, load capacity, and date of tests often tear, are bent,and lose their shape. Furthermore, the lightly scratched markings on the flat tag wear fairly rapidly. To improve the fastening and retention of tags with identification marks on the fastening devices, M. G. Kulakov has suggested the use at the Combine open-hearth departments of tags with rings machined on a lathe (Fig. 3).

The rings of diameter 60-80 mm are made flexible from 10-mm diameter bars. The tags are machined with rims, increasing the rigidity and preventing the identification marks from wearing. Holes are drilled in the tags near to the rim. The tag is placed on a ring and a split ring is placed between the strands of the cable or in the link of the chain. The ring is then pressed and the joint welded by electric welding. The new tag lasts 3-4 times longer than the old tags made from sheet.

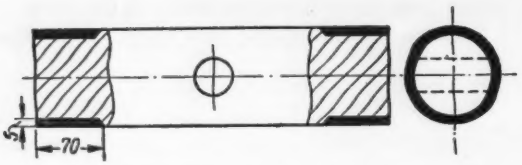


Fig. 2. Hard facing the surfaces of a charging machine lock.

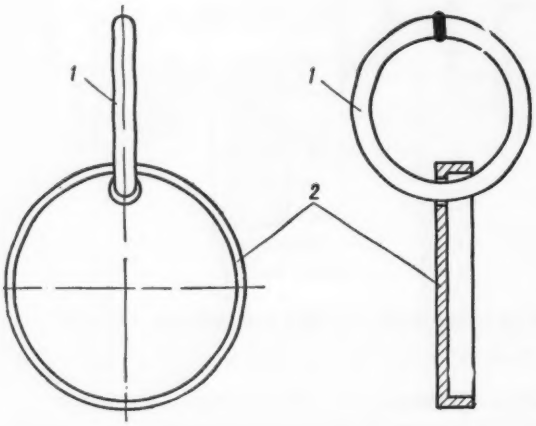


Fig. 3. Tag for fastening devices: 1) tag 2) ring.

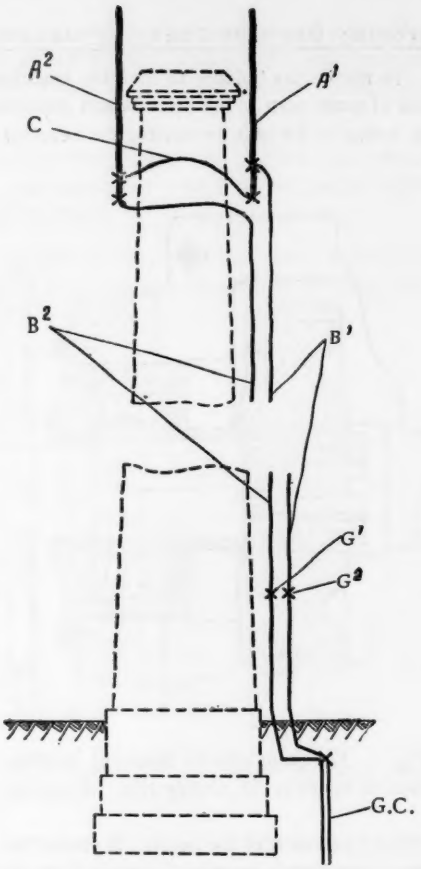


Fig. 4. Lightning protector system for smoke stacks.

A New System of Lightning Protection for Brick Smoke Stacks

In the inspection of lightning protection equipment for smoke stacks a visual check is made for the absence of tears and bad contacts between the components of the lightning protection equipment, a check is made of the resistance and completeness of the circuit of the upper and buried parts (from the lightning receiver to the bottom part of the current conductor),and the grounding resistance is also determined. For this purpose, in the bottom part of the current conductor there is a disconnecting switch which can disconnect the current conductor from the ground connection and connects the latter to the measuring circuit. To check the resistance and correctness of the circuit of the part above ground, it is usually necessary to ascend to the upper part of the equipment or to the top of the stack. P. K. Mednikov and Yu. P. Mednikov have made a suggestion for inspecting the part of the stack above the ground from the ground level. For this purpose, one of the two current conductors connecting the lightning receivers through a disconnecting switch with the ground connections is insulated. Figure 4 shows an arrangement with two lightning receivers for lightning protection of a smoke stack.

The lightning receivers A_1 and A_2 to which the current conductors B_1 and B_2 are connected are joined together by a conductor C, so that during the inspection the electric current passes not only along the current leads but also passes over a certain section along the length of the lightning receiver. One of the current leads is insulated from the stack in cable holders fastened along the body of the stack (lined with sheet rubber or some other insulating material). Both current leads B_1 and B_2 have at the base of the stack disconnecting switches G_1 and G_2 through which they are connected to the ground connections G. C.

The measuring instrument and the source of current are connected at the bottom of the stack to the current leads B_1 and B_2 with the disconnecting switches G_1 and G_2 open, so that during the inspections a closed circuit is formed containing both current leads B_1 and B_2, sections of the lightning receivers A_1 and A_2, and the connector C. This permits inspection of the above-ground part of the grounding device without ascending the installation.

THE USE OF SORTED AND GRADED SCRAP*

Translated from Metallurg No. 4, pp. 18-19, April, 1961

The Proler firm (USA) has built a department for the preparation of steel scrap for use in steel smelting. All contaminating impurities are removed from the scrap (paint, rubber, wood, nonferrous alloys) and it is cut into pieces convenient for charging and rapid melting in electric furnaces.

At the Armco Steel Company in Houston (Texas), they first started using this scrap in April, 1958. This scrap is now an essential part of the charge for electric furnaces (100-ton Lectomelt furnaces with top charging; the power of the transformers is 25,000 kw) in the smelting of both commercial and special carbon and alloy steels.

The use of this scrap as the charge for open-hearth furnaces at the plant is considered to be unsuitable, since more than 50% molten iron is added to the charge.

The scrap passes along a large conveyor (Fig. 1) to the sorting department where all harmful impurities are removed and it is cut up. Impurities (up to 20% of the weight of scrap received) are collected separately and the assorted scrap passes along a system of conveyors in gondolas to be unloaded by the user. A gondola usually contains 60-70 tons of scrap and the material is charged directly from the gondolas.

Figure 2 shows pieces of prepared scrap.

Fig. 2. Pieces of prepared scrap.

* Open-Hearth Proceedings (1959), Vol. 42, pp. 302-307.

To ascertain the desirability of using this scrap,a comparative study was made of 18 heats with a charge of 70% of the prepared scrap and 80 typical heats with heavy scrap. The yield of useful metal in heats with prepared scrap was 3.57% higher. The sulfur content in these heats was 0.010% less and the copper content 0.08% less. The time of the heats and the consumption of electric power per ton of steel hardly changed.

Because of the insufficient amount of prepared scrap and its relative expense (compared with heavy scrap), 70% of prepared scrap is only used for heats of special grade requiring a low copper content. At the present time electric furnaces use 30-35% of prepared scrap.

The mean density of the prepared scrap is 771.2 kg/m^3. Because prepared scrap has never been stored,no methods are known for its transport and protection against corrosion.

CLEANING THE REGENERATOR CHECKERWORKS OF OPEN-HEARTH FURNACES

G. A. Petrov, A. P. Klyucherov, and B. N. Shisharin

Nizhnii Tagil Metallurgical Combine
Translated from Metallurg No. 4, pp. 19-20, April, 1961

The use of oxygen at the large capacity open-hearth furnaces of our combine has led to an increase in the temperature level not only in the working space but also in the regenerated checkerworks, especially during the melting of the charge. At the same time there has been increased removal of smelting dust with the combustion products. In order to avoid reducing the life of furnaces, in the top 10-12 rows of the air checkerworks and 5-6 rows of the gas checkerworks,instead of dinas or fireclay we have started to use forsterite bricks. This simplifies the furnace operation,since there is no danger of overheating and fusing the checkerworks as was the case previously.

Forsterite bricks, in contrast to dinas and fireclay, have important advantages: being more refractory and slag resistant at high temperatures (up to 1400-1450°) they hardly ever fuse. The top rows of these checkerworks can be rapidly changed during any furnace repair. However, even the new forsterite brick, in contrast to dinas and fireclay brick, has poor heat-exchange properties, which become even worse during use, since this brick tends to crumble, peel,and be covered with porous smelting dust.

In the first months using oxygen,more intense wear of the checkerworks was observed due to finely dispersed smelting dust and slag, accompanied by a considerable increase in the hydraulic resistance and a deterioration in the heat-exchange processes in the regenerators. This was one of the most serious causes of disruption in open-hearth furnace operation, accompanied by a considerable drop in productivity and an increase in the specific consumption of fuel. To eliminate this the furnaces have to be stopped earlier for hot repairs with the replacement of the forsterite part of the checkerworks,and in a number of cases they had to be completely relaid.

With dinas and fireclay checkerworks, i.e., before the use of oxygen, on the basis of experience of other plants at a number of open-hearth furnaces of the combine,tests were made on different types of a boundary grating to trap the dust, installing them in the slag pockets or at the dam walls. To some extent these grates trapped the dust. However, under our conditions they were not successful since they rapidly collapsed, blocking the slag pockets or checkerworks.

Workers at the Nizhnii Tagil Metallurgical Combine and the All-Union Scientific Research Institute for Metallurgical Heat Engineering (VNIIMT) have developed and introduced a method for cleaning the air regenerator checkerworks from dust and slag deposits; they use compressed air at a pressure of 4-4.5 atm and water fed from a special pump at a pressure of up to 10-12 atm (since 1957). At the same time they have changed the system of lining the top rows of the checkerworks: instead of the Siemens checkerworks they have

started using Cowper checkerworkers with a gap in the fourth and eighth rows (counting from the top) of horizontal channels to take the dust-blowing pipe (Fig. 1).

To give a high exit rate of flow of compressed air or water, special 16-20 mm diameter nozzles were used, welded into pipes of 36 mm diameter and up to 7 m length (Fig. 2). On the other side these pipes have a connecting piece for connecting hoses and a handle for turning them or moving them in the required direction.

Starting at 30-50 heats after the cold repair, every week the checkerworks are given a routine blowing and washing. A special 3-man team spends about 6-7 hours on cleaning the two air checkerworks. During blowing or washing, the pipe with the nozzle is moved along the checkerworks, being slightly rotated about the axis. At first the upper row of checkerworks is cleaned and the pipe is held with the nozzle downward. The second stage is then cleaned in the same way. In the washing of the bottom stage the jet of water or air is directed upward (with the pipe moved forward) and downward, during the reverse movement.

The temperature of the top of the checkerworks during washing was reduced by about 200-250°; it is restored 2-2 1/2 hours after the end of washing.

Regular blowing and washing of the checkerworks keeps them clean throughout the whole campaign. Because of the high kinetic energy of the water jet it is possible to loosen and remove fairly dense and strongly sintered dust deposits. In this connection the compressed air is less effective, but it cools the checkerworks to a lesser extent.

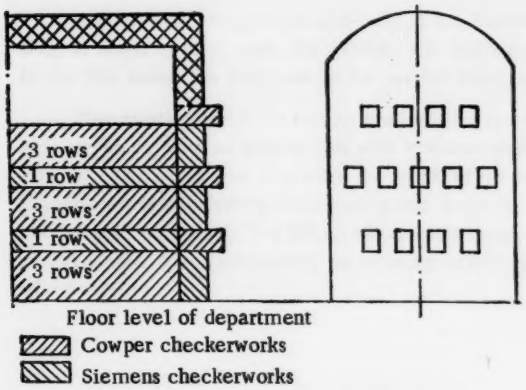


Fig. 1. New system of lining the upper rows of checkerworks.

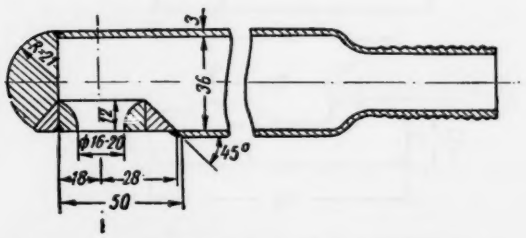


Fig. 2. Pipe with nozzle for washing checkerworks with high pressure water.

The Operation of High-Capacity Open-Hearth Furnaces

Indices	Age of furnace, heats			
	1—130	131—260	261—390	391—490
Length of heat, hr	9.74	9.78	10.05	10.25
%	100.0	100.4	103.1	105.2
Hourly productivity, %	100.0	99.84	97.41	95.21
Mean thermal load, million kcal/hr	24.6	25.4	25.5	26.4
%	100.0	103.3	107.6	107.3
Specific fuel consumption for heat, kg/ton	89.5	92.9	99.6	101.7
%	100.0	103.7	111.2	113.6

Note. The thermal loads and specific fuel consumption are shown without an allowance for the consumption of carburizing material (6-7 kg/ton of useful ingots).

Since August, 1960, in connection with the low pressure of compressed air, we changed over to the weekly washing of the checkerworks with water. It was then no longer necessary to wash the second stage.

The described method of cleaning checkerworks is only effective as a preventive measure. With a single washing it is possible to reduce the resistance of the checkerworks by 1-3 mm water column. If the checkerworks are strongly slagged then even washing does not give favorable results.

Splitting of the brick and deterioration in the life of the checkerworks made from roasted forsterite were not observed when they were washed with water.

Unroasted forsterite brick is unsuitable for these checkerworks.

Regular blowing and washing of checkerworks under conditions where oxygen is used, together with correct maintenance of the furnaces and the use of a strict system of preventive hot repairs (cleaning the slag from the slag pockets, replacing the upper rows of checkerworks, removing dust from the spaces near the checkerworks, etc.), ensures fairly uniform operation of the furnace throughout the whole campaign (Table). Compared with the first quarter of the campaign the furnace productivity toward the end of the campaign is only reduced by 4.8% and the specific consumption of fuel is increased by 13.6%. Previously these figures were 30 and 37%, respectively.

At the present time our combine and VNIIMT are working on the development of an industrial unit for the pneumatic removal of dust and slag deposits from around the checkerworks during the furnace operation, depositing them in special cyclones.

ECONOMICAL ROLLED SHAPES FROM ALLOY STEEL

M. V. Shuralev, Deputy Chief Engineer of the Zlatoust Metallurgical Plant, and S. G. Nekrasov, Siberian Metallurgical Institute

Translated from Metallurg No. 4, pp. 21-23, April, 1961

Mastering new economical rolled shapes is an important task in the technological progress of rolled stock production.

On the No. 2 three-high 400-mill of the Zlatoust Metallurgical Plant we rolled new economical shapes (Fig. 1) made of alloy steel 20Kh3MVF and 30KhGSA. Each shape is rolled in eight passes: the first five passes in the first stand, the sixth pass in the second stand, and the seventh and eighth passes in the third stand (Fig. 2).

The starting billet for rolling sections is a rectangular strip produced from an edging pass with rounded corners (Fig. 3); this permits us to change the width of the starting strip when transferring from rolling one shape to another and to regulate the filling of the subsequent closed passes, thus considerably facilitating adjustment of the mill.

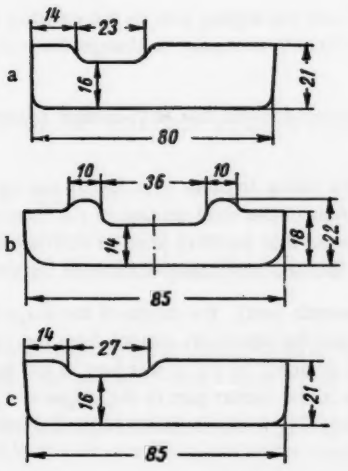


Fig. 1. Economical rolled shapes: a) GK-01; b) GK-09; c) GK-014.

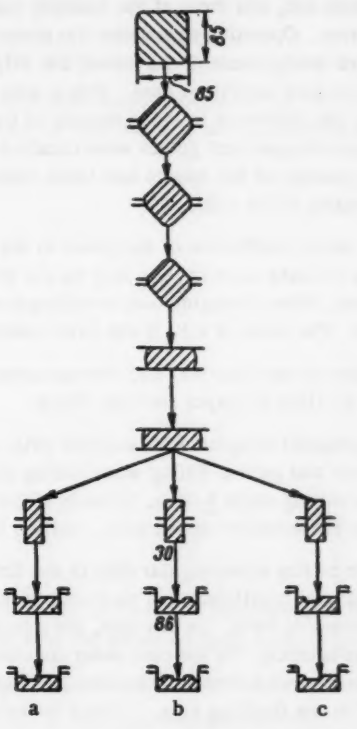


Fig. 2. Diagram of rolling shapes: a) GK-01; b) GK-09; c) GK-014.

Each of the three shapes under consideration is formed in two closed section passes (Fig. 4) designed for rolling with a limited spread, which contributes to a better filling of all elements of the shape.

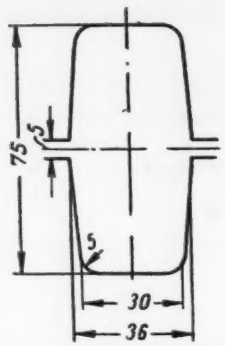


Fig. 3. Construction of edging pass.

When arranging the passes in the rolls of the third stand, we took into consideration that as a result of limiting the spread the strip becomes wedged in the closed pass and tends to bind the rolls. The closed grooves of the leader passes were therefore arranged in the middle roll, and those of the finishing passes on the bottom. Operating experience has shown that with such an arrangement of the passes, the strip gradually tends to bend downward. This is also favored by the difference in the diameters of the rolls. Simple forged steel guides were installed in the closed grooves of the middle and lower rolls to prevent binding of the rolls.

Analysis of Roll-Pass Design for Shapes GK-01, GK-09, and GK-014

Stand	Pass	Shape of pass	Dimensions of strip mm: Height	Width	Side of square	Cross sectional area of strip, mm²	Drawing coefficient	Angle of bits, deg-min	Shape
		Billet	—	—	85	7100	—	—	
	1	Square	—	—	78	5830	1.22	20—40	
I	2	The same	—	—	70	4820	1.21	24—50	
	3	" "	—	—	70	4680	1.03	15—30	
	4	Smooth	50	78	—	3650	1.28	19—20	
	5	The same	30	89	—	2550	1.43	18—45	
II	6	Edge	77	30	—	2300	1.11	15—30	
III	7	Section	25	79	—	1880	1.22	13—50	GK 01
	8	The same	21.5	80	—	1600	1.17	7—45	
I	5	Smooth	30	89	—	2550	1.43	18—45	
II	6	Edge	83	30	—	2480	1.03	11—0	
III	7	Section	26.5	86	—	1835	1.35	14—45	GK-09
	8	The same	22.5	87	—	1530	1.2	8—20	
I	5	Smooth	30	89	—	2550	1.43	18—45	
II	6	Edge	83	30	—	2480	1.03	11—0	
III	7	Section	25	85	—	2030	1.22	13—50	GK-014
	8	The same	21.5	86	—	1700	1.19	7—45	

The usual distribution of the passes in the stands required us to make a set of rolls only for the third stand and to bore the edging pass on the existing rolls of the second stand. When changing over to rolling economical shapes, it is only necessary to change the rolls on the third stand. The stock of rolls is cut down considerably.

Rolling of experimental and then commercial lots of new shapes showed that with correct adjustment of the mill, all sizes of shapes are fully filled.

We selected templets from suitable strips in the intermediate passes in order to ascertain the nature of strip-forming and groove-filling when rolling all shapes. An analysis of the cross section of the intermediate strips when rolling shape b (Fig. 1) made of 20Kh3MVF steel showed that the strip prior to delivery to the edging pass has severely convex sides. Rolling in the edging pass did not completely eliminate the convexity.

When rolling a rectangular strip in the first section pass (seventh pass), the ridges of the shape shrink due to the considerable difference in transverse reduction of the pass and the abrupt transitions from less reducible to more reducible parts. In this case, the side parts of the ridges adjacent to the center part of the shape are pulled more severely. In the case under consideration, shrinkage in the center part of the ridges is 4.9 mm and at the extremes, 6.6 mm. The final forming of the ridges and giving it the required shape and dimensions occur only in the finishing pass.

When rolling shapes a and c (Fig. 1), the filling of the leader passes with metal corresponds fully to that calculated. This is explained by the insignificant difference in the magnitude of transverse reduction of the grooves and by the smooth transition from more reducible parts of the shape to less reducible parts. The

asymmetrical arrangement of the depressions in the shapes causes the strip to bend in a horizontal plane during rolling, which is easily eliminated by lead-out guides.

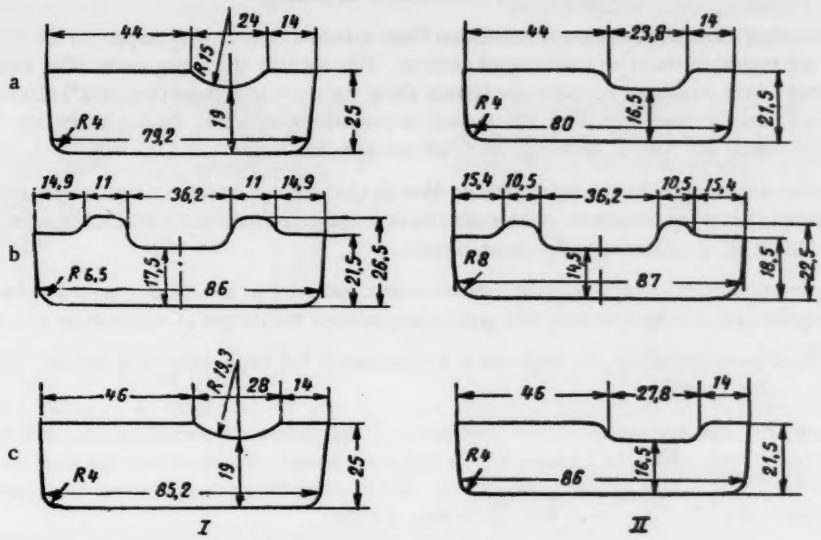


Fig. 4. Construction of passes for shapes: a) GK-01; b) GK-09 c) GK-014; I) seventh pass; II) eighth pass.

Data characterizing rolling of economic shapes are given in the table.

The use of the described shapes makes it possible to save at machine-building plants up to 22% of expensive alloy metal and considerably reduces the labor input required for machining when manufacturing machine parts.

PRODUCTION OF ROLLED BALL-BEARING STEEL

G. A. Khasin and V. G. Chikina

Zlatoust Metallurgical Plant

Translated from Metallurg No. 4, pp. 23-26, April, 1961

Rolled ball-bearing steel ShKh9, ShKh15, and ShKh15SG in sizes 10 to 53 mm is manufactured at the Zlatoust Plant. We use an 85-mm square bloom for shapes up to 48 mm, and above 48 mm, a 120-mm square.

The bloom is pickled and cleaned with abrasive disks before rolling. If a defect is found on one of the ten blooms selected for checking, the entire melt is pickled and cleaned again.

The metal for rolling is heated in continuous furnaces, some of which have bottom heating. The temperature of the bloom for the rolled steel should not exceed 800° before the welding chamber. The maximum heating temperature of the bloom is 1080°, the rolling rate is sufficiently high, about 80-100 blooms per hour on the merchant mills.

The quality of the surface of the rolled article is checked at the time of rolling by upsetting, etching the rods in acid solutions, by external examination, etc.; a check is made every 20-30 blooms. A check is made for nonmetallic inclusions in the steel in five specimens selected from different rods of finished grade. The rolled piece is checked for decarburization after intermediate annealing.

In order to satisfy the requirements of All-Union State Standard 801-47 with respect to the carbide network, the rolled rods are soaked in water on mechanized devices. This method of cooling metal after rolling in the temperature range where secondary carbides precipitate along the grain interfaces (900-700°) eliminates, for all practical purposes, cases of over-annealing with respect to the carbide network. During six months of 1960, over-annealing for this reason was 0.27%. Breakage from hot cracking was virtually nil.

Intermediate annealing of ball-bearing steel is done in chamber-type furnaces with a pull-out bottom and in furnaces with external mechanization. All furnaces have a one-sided arrangement of the burners and are equipped with automatic temperature and pressure control.

The programmed control of annealing assures automatic operation of the furnace according to preassigned conditions during the period of temperature rise and holding without the danger of overheating the metal.

Schemes have been worked out for large-scale automation of the entire annealing process, including also the accelerated cooling conditions.

Before annealing, the rods without a preexamination of the surface are packed in piles with three "fire" channels each 150-200 mm wide (for furnaces with a pull-out bottom); the piles have one fire channel 200 mm wide in furnaces with a stationary bottom. The rods are laid in rows with packing between them, which contributes to a uniform bathing of the metal with gases from all sides.

The conditions for intermediate annealing in furnaces with pull-out bottoms are as follows: heating to the holding temperature at a rate of 10° per 10 minutes; holding at a temperature of 760° for 1 hour, at 770° for 2 hours, at 780° for 4 hours, and at 790° for 4 hours for ShKh9 steel, 6 hours for ShKh15, and 8 hours for ShKh15SG. Step-by-step heating provides a good and uniform heating of the metal throughout the volume of the charge and an efficient operation of the burners.

The metal is cooled at a rate of 40° an hour to 700-720°, at which temperature the metal is given isothermal holding; then it is cooled to 600-550° (Fig. 1).

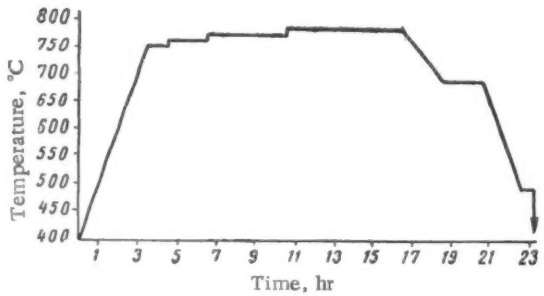


Fig. 1. Schedule of intermediate annealing of steel ShKh15.

In the first half of 1960, 0.79% of the rolled articles were sent back for reannealing due to unsatisfactory structure and hardness; 0.43% of the metal had decarburization greater than that permissible.

The metal prior to wire-drawing from a temperature of 600-550° is soaked in water to loosen and remove the scale from the surface. The remaining scale is eliminated in revolving drums and the metal is pickled in a solution of sulfuric acid with the addition of fused salt. After checking the surface, the rods are coated with a film of sodium nitrite, thus by-passing the oxidation process. For this purpose, parcels weighing up to 1 ton are charged by a crane into a metallic bath containing a 20% aqueous solution of sodium nitrite heated to 60-70° and held there 15-20 minutes. The parcel, taken from the solution, is dried by its own heat and a thin film of sodium nitrite is formed on the rods. The metal is nicely rolled when operating with such a coating.

Cold drawing is carried out with a reduction of 1-2 mm depending on the diameter of the starting bloom.

Mechanical press-fitting of the rods into the draw plate is used to save metal and increase productivity (Fig. 2). Here, the drawing operator feeds the rod to a carriage and by turning a handle squeezes it in jaws. By turning the idle sprocket wheel of the drawing mill, the levers built in the injection carriage are set into

motion by a crosshead and pull rods. The levers impart forward motion to the carriage with the protected rod, press it into the draw plate until the crosshead makes a maximum turn. As the crosshead turns further, the pull rods with the levers gradually move the injection carriage backwards, releasing for this purpose the rod clamped by the jaws of the stand.

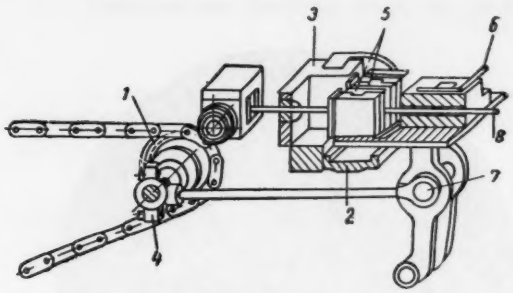


Fig. 2. Diagram of injecting a rod into the draw plate: 1) sprocket; 2) welded frame; 3) body of the injecting carriage; 4) crosshead 5) injecting jaws; 6) handle and levers for squeezing the jaws 7) connecting shaft of the link 8) rod being rolled.

Such a device makes possible a decrease in the consumption of metal in each rod by 60-70 mm of its length.

Rectangular electric bell-type OKB-426 furnaces with a protective atmosphere of commercial nitrogen were installed for bright annealing rolled steel. Each furnace consists of three stands, heat-resistant muffles, and one heating cover, which was installed alternately on each stand.

The stands were equipped with two seals: a sand seal for the muffle and a water seal for the foot of the cover. Banded heating elements were arranged on the four walls and on the roof of the cover, and wire heating elements on the stand of the furnace. The maximum charge weight is nine tons.

Test operation of these furnaces revealed a considerable number of shortcomings. The main faults are associated with the poor air tightness of the working space, the deterioration of the protective gas during heat-treatment (the appearance of free oxygen and CO_2), the nonuniform temperature distribution along the length of the stand (the drop is 200-300°). Fans for agitating the gaseous medium under the muffle were not provided for in the design.

The poor heat insulation of the heating cover led to buckling of the body and bulging of the brickwork. The furnaces were not equipped with measuring instruments for determining the composition of the protective gas or for its regulation both at the station for protective atmospheres or directly at the furnaces. The furnaces also did not have flowmeters or manometers.

Certain of these shortcomings could not be eliminated during operation. To improve the air tightness of the furnace, the brickwork of each stand was enclosed in a metal case. A metal sheet was fastened to the casing from the outside along the length of the furnace in order to deepen the sand seal (its depth was 100 mm).

Together with the workers of the Special Design Office, we remade the heating hood in order to improve its heat insulation; the outer water seal was replaced by a sand seal.

The gas lines from the general receptacle were remodeled, as well as the pipes leading to the furnaces: their diameter was increased to one inch; a diaphragm flowmeter was built into the exhaust pipe.

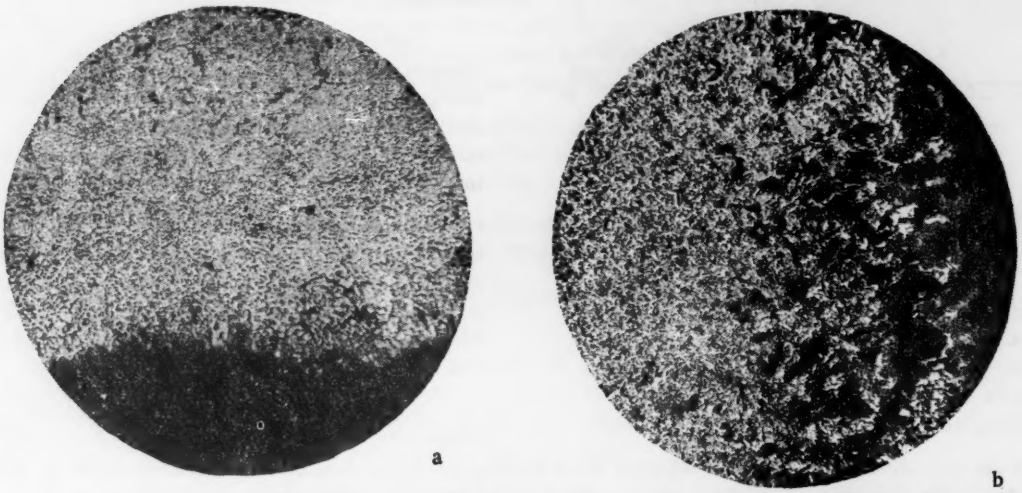
The roof and end heaters were completely disconnected in order to eliminate the large temperature gradient in the volume of the charge. We mounted into the brickwork of the stand two special pipes with outlets inside and outside the furnace; flexible thermocouples having regulating functions were inserted in these pipes, since it was impossible to judge the temperature distribution from the readings of the bell-furnace thermocouples.

The chases of the stand were remade: they were made on the same level as the stand's brickwork (in this case the stand heaters were moved 200-250 mm from the metal). The chases were staggered for a uniform heat exchange of the bricks.

But, in spite of such remodeling, the furnaces operate unsatisfactorily.

It is now proposed to dismantle them, since bright annealing in furnaces has been replaced by induction heating.

Bright annealing of rolled steel is now carried out in tubes at 720°, with holding for 12 hours and air cooling. About one ton of rolled rods is placed in the tubes sealed at one end. A protective atmosphere is developed in the tube by using a mixture of pig-iron shavings and charcoal. The open end of the tube is also closed tightly after the metal is inserted.



a b

Fig. 3. Microstructure of metal: a) before improvements; b) after improvements.

The quality of the annealed metal according to microstructure, decarburization, carbide network, and hardness is checked by 18-28 specimens from 9-10 rods located at different places in the charge during intermediate annealing and by three specimens from each tube after bright annealing.

The metal having decarburization above the standard are subjected to repeated oxidating annealing during which a portion of the decarburized layer becomes scale.

Annealing is done at 750-770° at a considerable air excess in the furnace (the excess air factor is $\alpha \approx 2$) due to the negative temperature (minus 1.5 mm on the bottom and minus 0.9 mm H_2O at the roof) and to opening the air slits of the burners. Such heat-treatment assures an improvement of 97% of the packs of metal rejected for decarburization. Figure 3 shows photographs of the microstructure of the metal before and after the improvements.

Etching of the decarburized layer revealed a poor surface quality of the rods and high losses of metal. The technology of producing ball-bearing steel used at the plant assures a sufficiently satisfactory quality of rolled steel. The output of suitable steel at the plant for ShKh9 and ShKh15 steel is 92.3% and for ShKh15SG steel is 91.3% of a given amount of rolled goods.

DESIGNING BOX PASSES

I. P. Shulaev

Magnitogorsk Metallurgical Combine
Translated from Metallurg No. 4, pp. 26-28, April, 1961

The structure of a box pass substantially affects carrying out the technological process of rolling, since the shape of the pass determines the conditions of metal deformation, the degree of filling the pass with metal, and also the character and magnitude of pass wear.

The main element of a box pass determining its shape is the delivery f (Fig. 1). The selection of the ratio between the width of the flat product being fed and the width of the groove bottom, as well as knowledge of the magnitude of spread are of considerable importance when designing a roll pass.

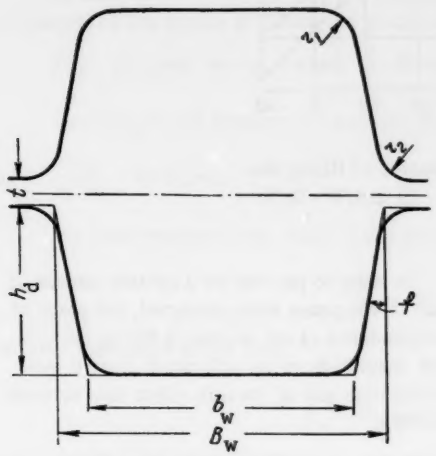


Fig. 1. Diagram of a box pass.

Determination of the magnitude of spread when rolling in box passes presents known difficulties, especially during continuous rolling where, as a result of the interaction of the stands, the flat product being rolled constantly experiences support or tension. Therefore, when calculating the roll passes of continuous billet mills the plant roll-pass designers usually use data accumulated over many years of experience for determining the magnitude of spread.

In our opinion, when selecting the parameters for designing box passes it is more expedient to use the magnitude of the degree of filling the pass, which more truly reflects the results of metal deformation in the pass.

Here we mean by the degree of filling the roll pass the ratio of the cross-sectional area of a rolled flat product F_r to the area of the groove F_g:

$$\theta = \frac{F_r}{F_g} \cdot 100, \ \%$$

The main elements of a box pass which must be determined when designing are the width of the pass bottom b_w, the depth of cutting-in the pass h_d, the delivery of the groove f, and the magnitude of the gap between the rolls t.

An analysis of the plant roll-pass designs showed that these values are used differently at different plants when designing box passes. However, there is much in common in the work of box passes on continuous billet mills:

a) The metal is rolled primarily with relative reductions of

$$\frac{\Delta h}{H} = 20\text{-}30\%;$$

b) The size of the gap between the rolls varies within the limits from $t = 0.1$ h in finishing passes to $t = 0.22$ h in roughing passes;

c) The width of the flat product being fed to the pass in most cases is equal to the width of the pass bottom, i.e., $b = b_w$.

As original starting data we always have the height and width of the flat product being fed to the pass and also the magnitude of the absolute reduction Δh. In the presence of these values we recommend, for determining

the parameters necessary for designing box passes, the use of graphs (Figs. 2 and 3), which are plotted on the basis of investigating the existing plant roll-pass designs of the continuous billet mills and also on the data we obtained while rolling lead in the box passes of the laboratory 250-mill.

Both graphs were plotted for the most widely-used case of rolling ($b = b_w$) which underlies the method being proposed.

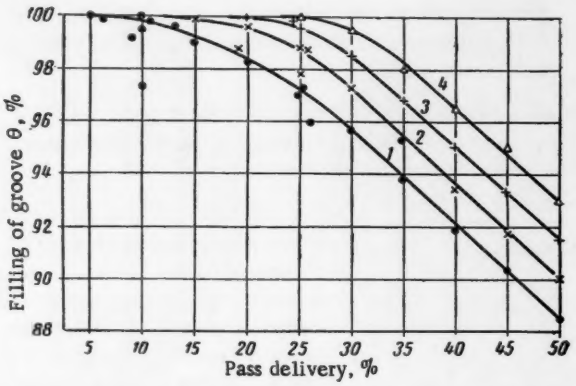


Fig. 2. Graph of the dependence of the degree of filling the groove on the value of the pass delivery: 1) $\Delta h/H = 20\%$; 2) same, 25%; 3) 30%; 4) 35%.

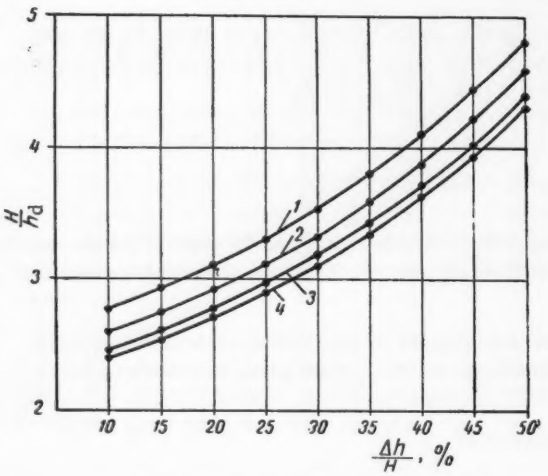


Fig. 3. Graph of the dependence of the relationship $\frac{H}{h_d}$ on the value of the relative reduction $\frac{\Delta h}{H}$: 1) $t = 0.2\,h$; 2) $t = 0.15\,h$; 3) $t = 0.1\,h$; 4) $t = 0.075\,h$.

In order to provide for a certain reserve of spread in the passes being designed, the graph of the dependence of the degree of filling the pass on the magnitude of its delivery is plotted with the minimum gap of the rolls taken into account; $t = 0.075\,h$.

On the basis of what was cited above, the parameters for designing box passes are determined in the following manner:

1) The width of the pass bottom is taken as equal to the width of the flat product being rolled;

2) The degree of filling the pass is given and the delivery of the pass is found from graph 2 depending on the magnitude of the relative reduction;

3) The size of the gap between the rolls is selected and the value of H/h_d, from which the depth of cutting-in the groove is determined, is found from graph 3;

4) The width of the pass is determined from the joint of the rolls

$$B_w = b_w + 2h_d \operatorname{tg} f;$$

5) The radii of the curvature of the pass r_1 and r_2 are taken according to B. P. Bakhtinov and M. M. Shternov's method: *

* Roll-Pass Designing of Rolling-Mill Rolls, Metallurgical Press, 1953.

$$r_1 = (0.12 - 0.20)b$$

and

$$r_2 = (0.08 - 0.12)b.$$

We will give below a sample calculation of a box pass for the first stand of the 720-mill.

Given. The height of the flat product being delivered to the pass is H = 285 mm, width b = 285 mm, reduction $\Delta h = 60$ mm, roll diameter D = 710 mm.

The value of the relative reduction

$$\frac{\Delta h}{H} = \frac{60}{285} \cdot 100 = 21\%.$$

We will assume the width of the pass bottom as $b_w = b = 285$ mm.

In order to avoid over-filling the pass when rolling average and high-carbon steels, we will assume the magnitude of the degree of filling the groove as B = 98%.

From the graph in Fig. 2 when $\Delta h/H = 21\%$ and $\theta = 98\%$, we determine the delivery of the pass: $f = 20\%$.

Assuming a gap between the rolls of t = 0.15 h, we find from the graph in Fig. 3 $\frac{H}{h_d} = 2.94$, whence

$h_d = \frac{285}{2.94} = 97.5$ mm.

We will determine the width of the pass by the joint

$$B_w = 285 + 2 \cdot 97.5 \cdot 0.20 = 324 \text{ mm},$$

we find the height of the pass

$$h_w = 2h_d + t = 2 \cdot 97.5 + 0.15 \cdot 225 = 228.7 \text{ mm}.$$

The height obtained is 3.7 mm greater than given for the pass. We correct the gap between the rolls for this value:

$$t = 33.7 - 3.7 = 30 \text{ mm}.$$

To check the degree of filling the pass that was taken in the calculation, we calculate the spread by Bakhtinov's formula*, which yields a good convergence with the experimental data within the reduction range we are considering:

$$\Delta b = 1.15 \frac{\Delta h}{2H}\left(\sqrt{R\Delta h} - \frac{\Delta h}{2 \cdot f}\right) = 1.15 \frac{60}{2 \cdot 285}\left(\sqrt{257.5 \cdot 60} - \frac{60}{2 \cdot 0.5}\right) = 16 \text{ mm}.$$

The width of the flat product after the pass will equal

$$b_1 = b + \Delta b = 285 + 16 = 301 \text{ mm}.$$

* Yu. M. Chizhikov, Stal', No. 11, 1948.

The area of the box pass and the area of the cross section of the flat product being rolled can be determined with a small error from the formulas

$$F_g = \frac{1}{2} h(B_w + b_w);$$

$$F_r = \frac{1}{2} h(b_1 + b_w).$$

Hence, the degree of filling the pass

$$\theta = \frac{(b_1 + b_w)}{(B_w + b_w)} \cdot 100 = \frac{(301 + 285)}{(324 + 285)} \cdot 100 = 96.4\%,$$

which attests to an accuracy of the calculation sufficient for practice.

The proposed method of designing box passes is based on a generalization of the considerable operating experience of plant roll-pass designs on the continuous billet mills, and therefore it can be used not only by plant roll-pass designers but also by workers of designing organizations.

AN EFFICIENT TECHNOLOGY FOR GRINDING ROLLED STEEL

V. K. Pasechnik

Zlatoust Metallurgical Plant
Translated from Metallurg No. 4, pp. 28-30, April, 1961

Rolled-steel rods are ground on centerless grinders. The article (a steel rod) is placed between two abrasive wheels: a driving and a working (grinding) wheel. The article is ground to a given size under specific conditions, such as the rotational speed and angle of inclination of the driving wheel, and the rotational speed of the grinding wheel. Pivoting of the rod and its longitudinal movement is done by the driving wheel, and the grinding wheel grinds the rod.

There are two methods of circular centerless grinding: with longitudinal feeding and plunge cutting. The first method is used for grinding rods of rolled steel.

The technology of grinding rods of rolled steel has been perfected in the hot-rolling shop of the Zlatoust Plant. This was accomplished in the following manner:

1) We determined the most efficient operating conditions of the grinder (angle of rotation and number of revolutions of the driving wheel) for grinding different steel sections and grades;

2) We selected wear-resistant PP500 x 150 x 305 abrasive wheels, which are highly productive and produce a good surface finish, for grinding rods of different steels.

Grinding was done on existing machines. For this purpose we recorded:

a) The operating conditions of the machine – the number of revolutions of the driving wheel (PVD 300 x x 150 x 127) and its angle of inclination (the number of revolutions of the PP 500 x 150 x 305 grinding wheel was constant, being 1200 rpm, which corresponded to a peripheral speed of about 31 m/sec);

b) The section, length, and number of ground rods;

c) The dimensions (diameter) of the grinding wheel before and after grinding the lot of metal;

d) The moving speed of the steel rods.

TABLE 1

Dependence of the Moving Speed of the Rod Being Ground and the Specific Consumption of the Abrasive Wheels on the Angle of Rotation and Rotational Speed of the Driving Wheel*

Steel	Diameter of rod, mm		Ground metal		Consumption of grinding wheel in kg for the entire machined metal	Operating conditions of grinder				Specific consumption of grinding wheel	
	Before grinding	After grinding	Kg	Running meter		Speed of driving wheel, rpm	Angle of inclination of driving wheel, deg	Moving speed of rod, m/min	No. of operations of the rod	Kg/ton of steel	Kg/1000 running meters of steel
R18	6.35	6.20	82	357	0.571	52	6	7.2	2	6.8	1.6
R18	6.35	6.20	45	196	0.727	52	3	2.2	2	16.3	3.7
R10A	9.15	9.00	448	901	0.852	52	6	6.6	2	1.9	1.0
R10A	10.15	10.00	247	408	0.973	52	3	4.7	2	3.9	2.4
R18	8.85	8.70	262	574	1.268	94	6	7.8	2	4.9	2.2
R18	8.85	8.70	280	615	1.671	52	6	5.1	2	6.1	2.8

* The driving wheel is É80STV, the grinding wheel É60ST2B.

TABLE 2

Recommendations for Efficient Speeds and Angles of Rotation of the Driving Wheel When Grinding Rods

Steel		Rod diameter, mm	Rpm of driving wheel							
			39		52		70		94	
			Angle of rotation of driving wheel, deg							
			3	6	3	6	3	6	3	6
U7–U13, 9KhS, N42 KhVG, 50KhFA	Silver steel	2–7								+
		7–10				+	+			
		Over 10		+	+					
1–4Kh13, R9, R18 1Kh18N9T, Kh18		2–7								+
		7–10				+	+			
		Over 10		+	+					
Kh9S2, 40Kh, 45, 60S2 Kh17N2, Kh10S2M, 55SMA 1Kh18N9T, Ya3S 1–4Kh13, Kh18, EI69	Ground	to 15				+		+		+
		Over 15			+		+		+	
		to 15				+		+		+
		Over 15			+		+		+	

Comment. Recommendable operating conditions of the machine are noted by a plus sign.

We determined the work of the grinding wheel by comparing several of the tests. They are therefore average values.

Table 1 shows the dependence of the moving speed of the rod being ground and the specific consumption of the abrasive wheels on the angle of rotation and on the rotational speed of the driving wheel. The data in the Table show that with an increase in the angle of inclination and the rotational speed of the driving wheel, the output increases and the consumption of the grinding wheel decreases.

This regularity is confirmed by comparative tests, on the basis of which we developed recommendations for efficient speeds and angles of rotation for the driving wheel when grinding steel rods of different grades and sections (Table 2).

We used abrasive wheels (PP 500 x 150 x 305) of different characteristics on ceramic and bakelite binders when grinding the rods.

We also worked out recommendations for efficient characteristics of the grinding wheels and determined their consumption norms (Table 3).

TABLE 3

Recommended Characteristics of PP 500 x 150 x 305 Grinding Wheels and Their Consumption Norms When Grinding Rods

Steel		Wheels on ceramic binder		Wheels on bakelite binder	
		Characteristic	Consumption norm, units/ /ton of ground steel	Characteristic	Consumption norm, units/ /ton of ground steel
U7 – U13, 9KhS, N42, KhVG 50KhFA 1 – 4Kh13, R9, R18, 1Kh18N9T, Kh18	silver steel	É 46ST1 – St2K	0.34	É 46 – 60ST2 – T1B	0.55
		É 60–80SM2 – – C1K	0.6	É 60S2 – ST2B	1.3
Kh9S2, 40Kh, 45, 60S2, Kh17N2, Kh10S2M, 55SMA	ground	É 46ST1 – ST2K	0.8	É 46–60ST2 – – T1B	1.16
Ya3S, 1Kh18N9T, 1 – 4Kh13, Kh18, ÉI69		É 46 – 60S2 – – ST1K	0.5	É 46 – 60ST2 – – T1B	1.24

The use of these recommendations in practice permits an increase in productivity, a 10% decrease in the consumption of hard-to-get grinding wheels, and an improvement in the surface of ground steel.

HEAT INSULATION OF THE HEARTH PIPES

V. N. Astsaturov

"Dnerospetsstal'" Plant

Translated from Metallurg No. 4, pp. 30-31, April, 1961

In the rolling shop of our plant we tested a new method of reinforcing hearth pipes in the three-zone continuous furnaces of the 550-mill for the purpose of retaining the fireclay concrete insulation.

The furnaces were heated with a mixture of coke-oven and blast-furnace gases with a heating capacity up to 2500 kcal/m^3; the maximum temperature in the furnace was 1350°; we heated in the furnace 140-180 mm square blooms weighing 450-750 kg, which moved by a pusher along four slide pipes 76 mm in diameter. In the continuous zone these pipes rest against the brick partitions and in the welding zone, on six support pipes 102 mm in diameter.

Bent rods were welded beforehand on the longitudinal and transverse hearth pipes to hold down the heat insulation (Fig. 1). During the first month of operation this insulation began to fall off and after five or six months only about 10-15% of the insulation remained on the pipes.

The destruction of the insulation caused a sharp increase in the specific consumption of fuel, a deterioration in the quality of heating, and a reduction in the productivity of the furnace. Whereas the mean monthly consumption in the first month of operation after repair usually does not exceed 80 kg/t, after four or five months it reaches to 90-95 kg/t.

Chases made of ordinary flat steel 9-10 mm thick and 40 mm wide were welded on two of the slide pipes instead of bent rods in order to hold down the fireclay concrete heat insulation (Figs. 2 and 3). The length of one chase is up to 900 mm. Originally the chases were cut out manually with simple gas-oxygen cutters, then we began to stamp press them. We set the teeth on a forge mandrel without heating and welded them to the tubes with a continuous running seam. The concrete mixture consisted of 75% fireclay powder with grain size up to 3 mm and 25% aluminous cement. The components were mixed by hand, first in a dry then in a moistened form. The concrete was laid in a 2-3 mm thick sheet-iron casing attached to the pipes directly in the furnace. We packed the insulation after this. Every 5-8 hours for three days, we moistened the exposed surface, then after a week the insulation was dried with the casing removed.

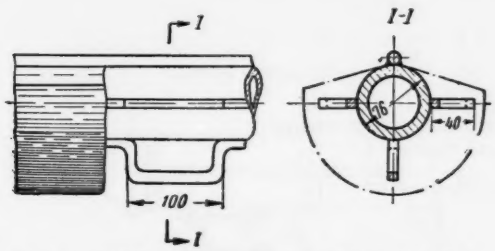


Fig. 1. Reinforcement of tubes with bent rods.

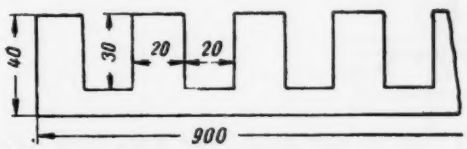


Fig. 2. Chase of flat steel.

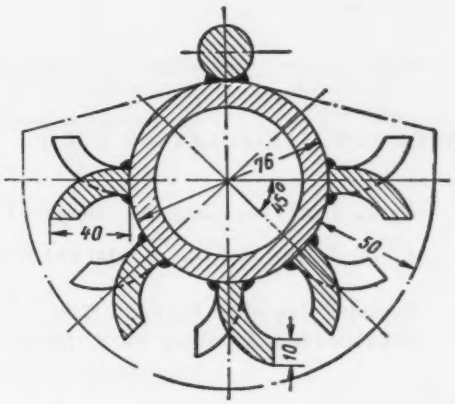


Fig. 3. Reinforcement of pipes with chases.

When the furnace was started up we increased the temperature to 120° at a rate of 20-30° an hour, held it there for 8-12 hours, and then increased the temperature further at a rate of 50-70° an hour.

The experimental insulation held up on two pipes during the entire operating period of the furnace and was still suitable for further use.

The retention of the insulation on only two longitudinal pipes lowered the average specific consumption for five months to 82 kg/t (instead of 87.5 kg/t with the usual insulation).

To increase the fire resistance of the insulation and to increase its resistance to the effect of scale, we recommend coating the fireclay concrete insulation with a type-Kh1400-1600 protective coating of the following composition, %:

	By dry wt. of mass	By volume
Chromite with Cr_2O_3 content not less than 35%	94	88
Fireclay (milled)	6	12

Sulfite waste liquor (commercial) with a sp. wt. of 1.2 in an amount of 4% of the weight of the dry mass or 7% of the volume.

The granulometric composition of the chromite is, %:

Grains smaller than 0.5 mm	60-70
Grains between 0.5 and 2.0 mm	40-30

The amount of water to produce the coating should be about 30-35% of the weight of the dry components. After mixing and moistening, the coating should be of the consistency of thick sour cream. The sulfite waste liquor is first dissolved in warm water based on 8 kg per vedro (vedro = 12.299 liters). Two or three coats are applied on the surface of the concrete, which is preliminarily moistened with an aqueous solution of the sulfite waste liquor, in layers not less than 1 mm thick. The total thickness of the coating is 2-3 mm.

From the editor's office. Although the method described in the article for insulating slide pipes yielded positive results, it is still imperfect. Its main shortcoming lies in the difficulty of changing the insulation after it crumbles, since the insulating material must be applied on the pipe in the furnace. Usually, the repair time of the furnaces is insufficient for a high-quality application and drying of the coating.

Insulating with blocks is a better method. In this method blocks are rammed and dried beforehand on the side and during repair they are just welded to the insulating pipes.

DEVICE FOR MANIPULATING STRIP

V. I. Sorokin, Deputy Chief of the Department, and

L. N. Goredetskii, Assistant Chief of the Equipment Shop

Structural Shop of the Petrovskii Plant

Translated from Metallurg No. 4, pp. 32-33, April, 1961

The 800-mill is arranged in a single line and consists of three two-high stands. One of the stands is designed for rolling billets 140 x 140, 140 x 120 mm, and commercial tube billets; the other two stands are for rolling flanged shapes (beams, channel beams, crane rails) and commercial square blooms 100 and 120 mm.

The mill had been serviced by 10 rolling operators per shift. They not only had to manipulate the metal by hand, but also had to transfer the strip being rolled from pass to pass. The most labor-consuming shape is the tube billet, during the rolling of which the strip is manipulated after each pass (seven passes with six manipulations).

On the suggestion of I. I. Zaichenko, V. F. Povar, and F. A. Zaichenko, workers at our plant, manipulation and transfer of the strip was mechanized; manipulators with hydraulic heads were installed on both sides of the stand (Fig. 1).

The hydraulic head and the manipulating cylinder were mounted on a special carriage that is moved along guides on the roller supports by an electric winch. In the starting position, the clamping rollers of the manipulating head are separated to the maximum and are horizontal. In this position, the lower roller is lowered below the level of the roll table. When the leading end of the rolled strip issues from the roll pass, the winch operator regulates the hydraulic head so that the strip is between the slamping rollers. By the time the strip completes the pass the heads have fed water under a pressure of 25-30 atm into the hydraulic cylinders, as a result of which the rollers are squeezed together and seized the strip.

Manipulation begins only after the strip being rolled leaves the roll pass. Under the effect of the water being fed into the manipulating cylinder, the hydraulic head turns together with the rolled strip. The operator turns on the winch, thus moving the frame of the manipulator, and sets the strip opposite the next roll pass.

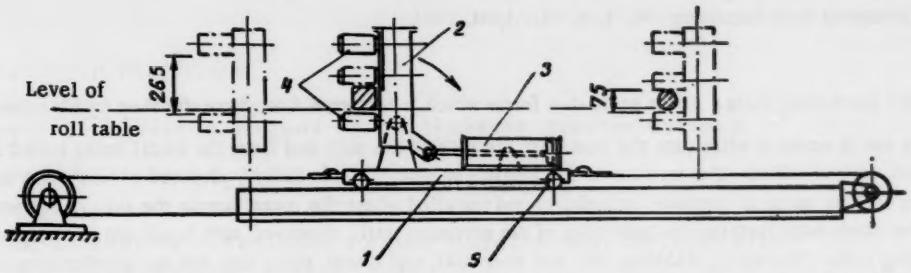


Fig. 1. Manipulator: 1) carriage; 2) hydraulic head; 3) manipulating cylinder; 4) clamping rollers; 5) rolling support of the guides.

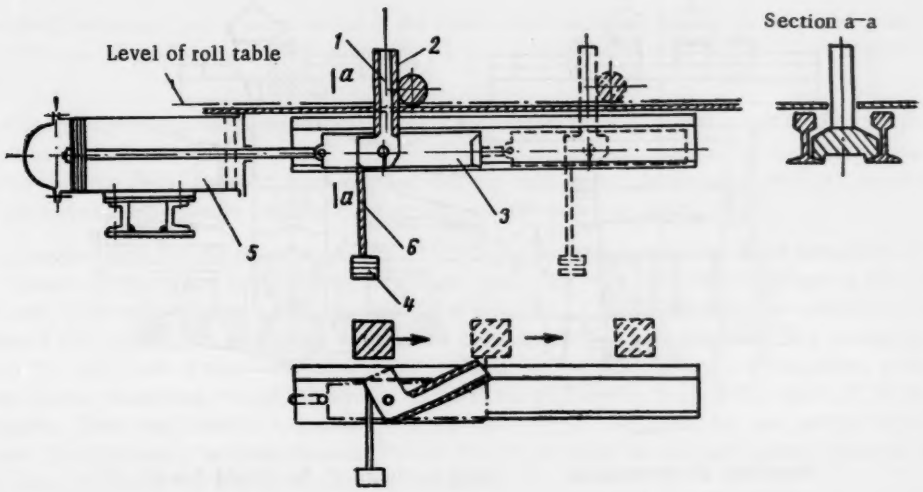


Fig. 2. Disappearing recoil roller: 1) pin; 2) bush; 3) slide blocks; 4) load; 5) air cylinder; 6) cable.

We developed a disappearing recoil roller (Fig. 2) to mechanize the feed of the strip into the rolling groove. In the starting position, the pin is under the plate covering and only at the time of manipulation does it come out from under it.

Mechanization of the rolling operators' work increased the pass capacity of the mill, saved more than 5000 rubles, and made it possible to release four rolling operators for other work.

ELIMINATION OF DUST FROM THE WORKING STAND OF A MILL

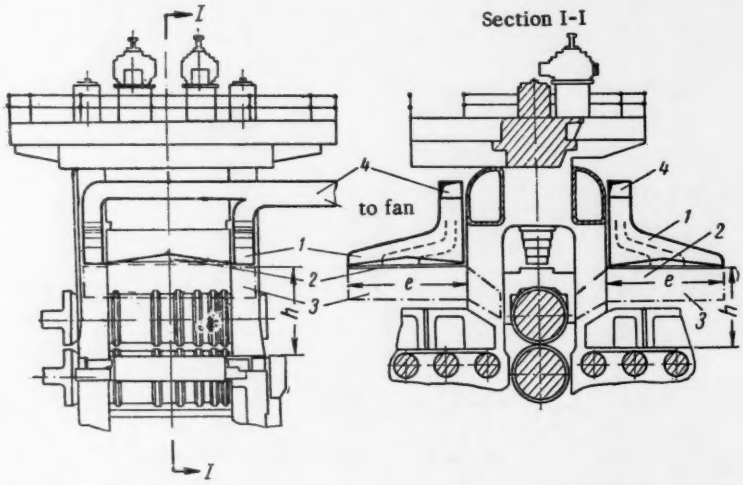
M. V. Pal'shin

Director of the Laboratory of Sanitary Engineering, Scientific-Research Institute of Industrial Buildings of the USSR Academy of Construction and Architecture

Translated from Metallurg No. 4, p. 33, April, 1961

When hot rolling metal, a fine scale dust forms which is scattered throughout the shop by air currents.

The use of water to eliminate the dust from the rolls of the mill and from the metal being rolled does not produce the desired effect. The workers of the Tbilisi Institute of Labor Safety, proposed to eliminate dust from the rolling mill by using an ordinary pyramidal hood installed where the metal leaves the rolls of the working stand. The hoods were installed on both sides of the reversing mill. However, such hoods are unacceptable on large rolling mills (blooming, slabbing, rail and structural, and sheet) since they are too cumbersome and hamper maintenance and repair of the mill. In addition, it is necessary to exhaust from the hood too much air in order to develop the suction rate recommended by the Institute.



Hood with flange suctions: 1) flange suctions; 2) flat shield (hood); 3) curtains; 4) air lines.

Local suction from the working stand can be made most efficiently in the form of a hood with two flange suctions (figure) which are connected by air lines to the fan and dust-removers (SIOT dust extractors).

The overhang of the hood e equals the height h at which the hood is installed over the level of the roll tables. The height of the hood installation is generally determined by how easy it is to service the mill during operation and repair. The hood width equals the width of the working stand.

The advantages of a hood with flange suctions over the usual pyramidal hood are: 1) A considerable area above the dust source can be overlapped without increasing the volume of air being exhausted; 2) when the rollers of the roll table or the rolls of the mill are replaced by a bridge crane it is not necessary to disconnect the flange suctions from the air line since it suffices to remove only the flat shield which freely lies on the support structure of the hood; 3) the range of exhaust speeds is considerably improved, i.e., the speeds are increased from the sides of the hood where dust is driven out from under an ordinary hood owing to a decrease in the speed.

A continuous flow of ascending air, which is called a thermal current, is formed over the heated bodies. A volume of air not less than the volume flowing under the hood must be exhausted when removing the dust-ladened heated air from the hood.

For a more reliable operation of the hood, the volume of air being exhausted should be 10% greater than the volume flowing under the hood.

CREATIVE COOPERATION

(Concerning the Mixed Brigade of Chelyabinsk Tractor Builders and Dneprodzershinsk Rolling-Mill Specialists)

Ya. R. Bukhman, Engineer for the Development of Innovation at the Chelyabinsk Tractor Plant

Translated from Metallurg No. 4, pp. 34-35, April, 1961

The careful economic use of metal is one of the main conditions for increasing the output of goods, for decreasing their cost of production, and for improving the technical and economic indexes of the operation of enterprises.

The Chelyabinsk tractor builders constantly search for reserves for a more effective use of rolled products. They established a close contact with a number of metallurgical combines in the country and systematically send their creative brigades there; these brigades together with the metallurgists develop and carry out valuable technical measures directed toward creating more economical and efficient rolling shapes.

Thus, together with the rolling-mill specialists of the Magnitogorsk and Nizhne-Tagil Metallurgical Combines and Zlatoust Metallurgical and Pervoural New Tube Plants, the tractor builders have created and put into production new, light-weight shapes for rolling which save thousands of tons of metal for the national economy. Having learned that preparations were being made at the Dneprodzerzhinsk Metallurgical Plant to start up the 120-mill for the production of transverse-screw rolled products, we immediately sent representatives of the Chelyabinsk Tractor Plant there – S. M. Matovskii, Chief of the Engineering Department, and V. N. Fal'kov, Senior Engineer. There they became acquainted with the 120-mill, a unique unit that can produce rolled products with a longitudinally variable diameter. These are very suitable for the manufacture of various stepped shafts and axles, by-passing the forging or stamping operations.

Having become acquainted with the equipment and technology, the representatives of the tractor plant, together with the metallurgists,worked out the technical specifications for the production and delivery of more economical sections. The first lot of rolled products for the manufacture of axles and divided axles were soon received from Dneprodzerzhinsk.

However, a number of serious faults were detected after working the experimental lot: nonobservance of dimensions, increased curvature, and an unsatisfactory condition of the base surfaces. All this hampered cutting of the parts, the benzene-oxygen cutter could not provide the necessary accuracy of the part.

Technologists S. M. Matovskii and P. T. Poletskii, having carefully studied these defects, made changes in the design and technical specifications. The necessary material was gathered and S. M. Matovskii and A. I. Savinok, engineer of the chassis shop, left for Dneprodzerzhinsk. Together with the rolling-mill specialists, they discussed the noted defects and took measures to produce uniform products for the divided axles and made the tolerances for the accuracy of the rolled product more drastic.

After finishing this work, S. M. Matovskii and A. I. Savinkov, along with A. L. Krzhizhanov, chief rolling-mill specialist of the Dneprodzerzhinsk Plant,and Comrade Fradkin, Production Chief, left for Moscow where they reformulated the funds for metal.

CHARGING THE CALDRON*

Translated from Metallurg, No. 4, p. 35, April, 1961

The steelmaking department of the Armco Plant in Butler Co., Ohio (USA) has six open-hearth and one electric furnace. Previously, the charge for the open-hearth furnaces had been delivered by buggies. Thirty-five buggies with five charging boxes (capacity of 0.78 m^3) on each were required to charge one furnace.

To improve the organization of work on the working platform of the shop, a new method was proposed for charging the open-hearth furnaces by delivering the charge to the furnace not in small portions, but in large masses.

The scrap in the charging yard is loaded by bridge cranes into gondolas that are 10.26 m long having a capacity of 45.3 tons and sent to the working platform. Here, specially designed hoppers were installed on the buggies. Three charging boxes were placed under each hopper. The metal charge is transferred by magnetic grabs to the hopper situated at the end of the gondola in front of the furnace where charging will be conducted.

When the gate of the hopper is opened, the charge flows into the middle charging box, and the excess into the side boxes. The loaded charging box is emptied by the charging machine into the furnace and again placed under the bunker. As the side charging boxes fill, they are also discharged into the furnace.

During prolonged charging, the middle charging box becomes severely overheated and is therefore replaced by one of the side ones. It is recommended to change the charging boxes every 10-15 cycles to prevent overheating.

This method of charging is 15% faster than the usual method and in quantity of material, one gondola replaces ten buggies and saves 26.2 m of trackage, which can be used for delivering the charge beforehand. A complete cycle-weighing, delivering the charge to the furnaces, and arresting the empty car, is 49% shorter than the usual cycle.

Since the charging machine need not release the peel after dumping each charging box or move the buggies, the duration of charging is reduced about 30%. But for a complete utilization of the advantages of this method, it is necessary to coordinate the operational cycle of the bridge crane from the gondola to the bunker with the charging cycle.

This method of charging is suitable for any type of scrap; however, a significant effect is obtained when there is a large amount of scrap. The least effective results are obtained when using this method to charge pig iron, broken molds, dozzles, and other heavy scraps.

The following sequence of charging is suggested after the shop is fully provisioned with crane equipment and the necessary number of gondolas and hoppers. After unloading the loose material, using buggies and charging boxes, two gondolas are placed near the furnace, one on each side of the hopper. First the scrap is unloaded from the gondola standing at the shop exit. While unloading the second gondola the first one will be replaced, thus assuring a continuous delivery of the charge for charging each melt.

It is suggested that this method of charging and the use of oxygen in the flames will eliminate the need for heaping the charge into the furnaces and will reduce the over-all duration of charging from 5.5 to 3-3.5 hours.

This method of charging received the name "Charging the Caldron."

* Open-Hearth Proceedings, Vol. 42, pp. 308-312 (1959).

Thus, one of the country's first mixed brigades, consisting of the Chelyabinsk tractor builders and the Dneprodzerzhinsk rolling-mill specialists, was founded and works creatively. The fruits of its labor are already apparent. The Dneprodzerzhinsk workers have set up production and regular shipment of transverse-screw rolled goods for the manufacture of divided axles. The new shape permits a considerable reduction in material and labor expenditures.

It was, heretofore, necessary to machine the blanks and then drop forge them in order to manufacture forged pieces for the divided axle of the S-100 tractor. The forged piece weighed 63 kg, the part after machining, 51.2 kg.

The Dneprodzerzhinsk workers deliver uniform blanks of the divided axles made by transverse-screw rolling to the Chelyabinsk Tractor Plant, where they are immediately machined. Thus, in the manufacture of parts now, the metal going into shavings is less than a third of that before. As a result, the annual savings is more than 700 tons of metal.

This does not exhaust all the advantages of the new shape. The use of the transverse-screw rolled product made it possible to release in the course of 20 shifts the powerful and hard-to-get stamping hammer, 12 forgers, considerable steam, fuel oil, power, dies and tools, to reduce considerably the losses from breakage, and to lower the labor consumption for manufacturing a single set of parts by 28 minutes. Thanks to the use of this light-weight shape, the transverse-screw rolled stock saves more than 70,000 rubles a year just in the manufacture of divided axles.

The continuous brigade of the Chelyabinsk tractor builders and the Dneprodzerzhinsk metallurgists have also done considerable and fruitful work to develop a more economical rolled shape for the manufacture of a distributing shaft for the KDM-100 motor. After mastering and refining the part, the forgers of the Chelyabinsk Tractor Plant made an agreement with the Dneprodzerzhinsk workers concerning the blueprints and technical specifications for the blanks of periodic rolled shapes. Since October, 1960, the forgers have already manufactured distributing shafts from this type of rolled shape, thus saving 2 kg of steel when stamping each part, eliminating one of the labor-consuming operations, and cutting down breakage.

The operating experience of the mixed brigade of tractor builders and rolling-mill specialists shows what great reserves in savings of metal can be put into effect and placed at the service of the national economy if constant contact and creative cooperation between machine builders and metallurgists is established.

THREE EVENTS

Translated from Metallurg, No. 4, p. 36, April, 1961

In the near future the metallurgical plants of Diosgyor will note the anniversary of three significant events. This will be a national holiday for the entire Hungarian nation because of the steel foundries at Diosgyor, one of the largest enterprises of the Hungarian heavy industry. Their history is the history of the development of all Hungarian industry during the last two centuries.

One hundred and ninety years ago,Henrik Fazola, master of a locksmith shop in Eger, built the first Hungarian iron smelting furnace in Omasa, and 40 years later his son Firgis Fazola built the first Hungarian steel foundry in Omasa.

In the second half of the 18th Century,when the demand for metal had sharply increased, Henrik Fazola bought an iron-ore mine. The owners of the mine in the Bükk and Matra Mts. were mainly miners and Fazola, although he knew the mining business,was nevertheless a metallurgist; moreover, he was simply a locksmith. His main purpose was to build an iron foundry. When Fazola acquired the equipment and mine which he needed, he began the construction of a casting shop. Soon Diosgyor steel became known throughout the country.

The shop primarily produced semifinished goods. When Diosgyor steel became known as one of the best in the country, a plan was worked out to expand the shop, which was done in the following years.

Unfortunately, Fazola knew economics poorly and, therefore, the difficulties he encountered in organization of production and transportation made him financially dependent on the "Mining Treasury" in Vienna, which appropriated the greater part of the profits.

The second event is connected with the name of Firgis Fazola, son of the founder. The young Fazola on finishing the mining academy at Selmeczbanya worked for a while at steel foundries in Styria and Carinthia, where he received practical knowledge on refining iron and on steel production. When he was 26 years old, already being an experienced specialist, he returned to his native city and proceeded to the iron foundry in Diosgyor, where he soon took over very responsible work.

Frigis Fazola began his experiments in 1800. The purpose of his experiments was to produce a steel from Hungarian iron that would have the same properties as English steel, which at that time was considered to be the best in Europe.

By the end of 1802, after numerous experiments, he succeeded in producing a refined steel differing little from the English.

Experiments were conducted on Diosgyor steel in 1808 which showed that in no way was it inferior in its properties to English steel. In 1809,Frigis Fazola was named director of the metallurgical plants in the southern mining region of Hungary. In addition, he became head director of the Diosgyor Plant.

After the war for independence, the plants of Diosgyor-Hamor underwent a certain change. In 1867,after the compromise agreement between Hungary and Austria,they were transferred to state ownership.

The third period is associated with the development of new metallurgical enterprises in Diosgyor, the direct forerunners of today's metallurgical plants.

In order to use the iron-ore and coal deposits discovered in the northern region of Hungary, the government decided to build an enterprise between Miskolc and Diosgyor in the picturesque valley of the Sinva River.

Two world wars and the economic crises which broke out after them severely retarded the development of industry in Hungary. When the Second World War ended, a new plant in Diosgyor, which was under separate management, became part of the entire industry. A period of rapid development began after reconstruction.

The workers of Diosgyor who this year will celebrate the glorious anniversary will remember those who by their labor helped to create and develop this reknown metallurgical enterprise.

IN THE LAND OF CONSTANT SUNSHINE

(The Trip of the Soviet Trade Union Delegation to Chili)

V. A. Podzerko, Chairman of the Central Committee of the Trade Union of Workers in the Metallurgical Industry

Translated from Metallurg, No. 4, pp. 37-38, April, 1961

The international relations of our country grow stronger and wider. All the more frequently we can find on the streets of Moscow, and not just Moscow but other cities of the Soviet Union, foreign tourists and all kinds of foreign delegates who personally want to be convinced with their own eyes of the enormous successes which our country has attained. This once again attests to the fact that, in spite of both obstacles and untruthful nonsense which the bourgeois press crams into its readers, the simple people of the entire world want to know the truth about the Land of the Soviets, the foremost land on earth.

The Soviet people, in turn, are willing to go to other countries and realize that their trip is still another gap in the "Iron Curtain" behind which the imperialists of the entire world wish to hide the truth concerning our country.

At the end of September, 1960, the Soviet Trade Union Delegation consisting of V. A. Podzerko (head of the delegation); I. A. Tristan, Chairman of the Ukrainian Republic's committee of workers of State Institutions; A. T. Orlov, chairman of the factory committee of the Ivanov Melange Combine; and V. V. Listov, interpreter, flew to Chile on the invitation of the three branches of the Federation: metal workers, state workers, and textile workers.

Finger printing was required to fill out the Chilean visas at the Chilean Embassy in Paris. The delegation, availing itself of the Chilean law permitting entrance to the country for a period up to 90 days without visas, went to Chile without them. But, nevertheless, to "legalize" its stay in the country the delegation paid visits to Sotero del Rio, Minister of Internal Affairs, Hugo Galves, Minister of Labor, and to Ramon Alverez Goldzak, Governor of Santiago Province. All these meetings took place in an atmosphere of hospitality and friendship.

Since the delegation consisted of workers of the trade unions of the metallurgical and textile industries, as well as of workers of State institutions, it was mainly interested in becoming acquainted with the enterprises of these branches of industry, the working conditions of the workers and office personnel, and with the status of the trade unions, which are united by three federations – the metal workers, State workers, and textile workers. In Santiago, one of the largest cities in Chile, the delegation visited a number of textile factories, the metal-working plant "Mademsa," and the railroad depot "San Bernardo." The members of the delegation repeatedly met and conversed with the directors of the national federations. All these meetings bore a friendly character.

When the delegation arrived at the industrial enterprises, it was literally smothered with questions concerning the position of workers in the Soviet Union, the activity of the Soviet trade unions, the course of fulfilling the Seven-Year Plan. This once again testifies to the enormous interest in our Motherland which is manifested by workers of all countries. Mass meetings occurred almost in all large cities that the delegation visited.

In Concepcion, the members of the delegation visited the metallurgical combine "Huachipato," the railroad-car repair shops, and the railroad depot, and also visited the "Cousino" and "Shuager" mines in the coal

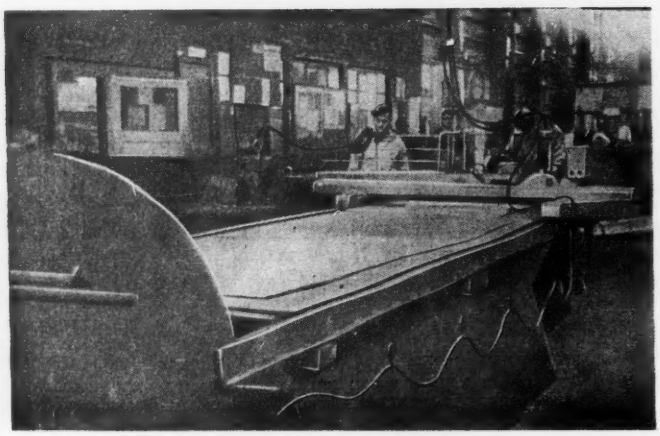
region of Lota and Coronel. In Cautin Province, they became acquainted in detail with the conditions of life and work of the Chilean Mapuche Indians. While traveling through the southern provinces, the delegation visited the cities of Valdivia and Puerto Montt, which were severely damaged from an earthquake. At meetings in these cities, the delegation members discussed the help rendered by the Soviet trade unions to the inhabitants of the damaged regions.

Member of the Soviet delegation with inhabitants of Tempuco.

The two meetings organized by the Institute of Chilean-Soviet Friendship were especially impressive: the first meeting was with the directors of the institute, and the second with the active youth of the organization. These meetings took the form of a distinct demonstration for strengthening Chilean-Soviet relations, for peace throughout the world.

Press conferences were organized in Santiago, the capitol of Chile, and in Valdivia. The answers of the Soviet delegation to the questions of the Chilean journalists were widely elucidated in the local press, and two of the three radio stations in Valdivia translated this press conference on the radio. During the meetings and conversations, many trade union workers discussed the dissentient activity of the American reactionary trade unions, which, by using their agents in the trade union movement, preach the ideology of reformism and class cooperation. There are various courses and schools to train these agents, and the Chilean trade unions must constantly reject persistent invitations to send their active members to these courses.

An extremely serious internal political situation has now arisen in the country. This situation is aggravated by such factors as the critical events that have recently been intensified in industry, the constantly growing number of unemployed (about 200,000 completely and another 200,000 partially unemployed), the increase in taxation, the high cost of living, an intensification in the strike movement (in October, 1960, there were 12-14 strikes daily), the increase in the revolutionary mood among the peasantry under the influence of the Cuban revolution. The strike movement has recently become intensified among the white-collar workers. All this leaves its imprint on the position within the Front of People's Action and the United Trade-Union Center of Workers.



At the "Huachipato" Combine.

Various opinions, for example, exist within the Front concerning the way to escape the situation that has developed; the majority consider that it is necessary to carry out an agrarian reform, nationalize the enterprises belonging to foreign capital, to establish and develop trade relations with the Soviet Union and countries in the socialist camp. But there are also those who propose to develop a program of "national demands" and present them to the government as an ultimatum. The government exerts every effort to split the United Trade-Union Center.

But in spite of this, the strike movement in Chile constantly grows.

The workers and peasants of Chile are no longer limited to an economic struggle. All the more frequently their demands acquire a political character. This matter frequently results even in a direct encounter with the government troops. As an example of this, we can cite the fact that the general assembly of workers at the "Mademsa" Metal-Working Plant through the leaders of the United Trade-Union Center, turned to the Soviet delegation with the request to invite a worker at their plant who received a bullet wound in the spine during the last strike for treatment, according to the policy of the Central Committee of the Trade Union of the Metallurgical Industry.

During the three weeks (from 3 to 26 October) the members of the delegation spent in Chile on a visit of friendship, they travelled hundreds of kilometers, visited tens of enterprises, met a multitude of people, and everywhere they went, with whomever they conversed, great interest and attention were shown toward our country by the simple people of Chile.

HOW THE PLANT BECAME PROFITABLE, I. M. Ektov,

Stalino-Donbass, 85 pages, 1960

M. Kamenskii, Deputy Chief of the Technical Department,
Stalino Metallurgical Plant

Translated from Metallurg, No. 4, p. 39, April, 1961

Not very long ago, in 1958, the Stalino Metallurgical Plant was one of the enterprises that received a subsidy from the budget. Such plants, as the July Plenum of the Central Committee of the Communist Party of the Soviet Union pointed out, are a strong braking force to the further growth of the socialist accumulations. The expenditure per ruble of commodity output at this plant was 104.8 kopeks. Therefore, the book by I. M. Ektov, director of the Stalino Metallurgical Plant, is of interest for workers at industrial enterprises.

Having prefaced the main material with a short introduction and a brief historical survey, the author tells about the work of the plant after reorganization of the administration of industry and construction. Within three years the gross output increased by 41.1%, production of high-quality steel and complex rolled sections was expanded. The main technical and economic work indexes improved from year to year. The new conditions opened wide possibilities for creative initiative and helped to reveal unused reserves.

Before turning to the problems of cost accounting and reconstruction of the economic activity of the enterprise, the author dwells in detail on the "initial positions." In 1958 the plant, having fulfilled the plan for the entire metallurgical cycle, tolerated considerable over-the-plan losses due to the heavy overexpenditures with respect to cost of production, losses in nonproductive expenditures, etc. Therefore, it was decided to analyze the causes for the unsatisfactory economic activities and to search for means to reorganize and eliminate these shortcomings. Measures were noted for reducing nonproductive expenditures, for a timely filling of orders (thus eliminating fines). They began striving to get orders for the entire assortment of goods set forth in the production plan and to improve the quality indexes; this assured the receipt of additional payments and a decrease in rebates called for by the price lists.

A number of organizational measures were carried out. The fulfillment of the plan was now calculated not by the delivery of finished products to the warehouse, but by their shipment strictly according to the orders of the current month. The shop became responsible not only for a decrease in the unit cost of production, but also for profitableness. This radically changed the target of the shops. Detailed data are cited in the book concerning these changes and also concerning how the economic activity of the shops is estimated for the current month. The work of the so-called balancing commissions is described in detail; these commissions, held by the management in all main and certain auxiliary shops, give the results of the financial and economic activity and attract a wide circle of engineers, workers of most departments, and research laboratories of the plant and shops.

A separate chapter of the book is devoted to problems of introducing new techniques and advanced technology: it describes in detail the smelting of low-manganese pig iron; the conversion of blast furnaces that smelt steelmaking pig iron, foundry pig iron, and ferrosilicon over to operation with natural gas; the mastering of high-speed fritting of open-hearth furnaces; injection of ventilation air into the flame of the open-hearth furnace; automation and mechanization of individual sections and units of machinery in the rolling shops; and the utilization of precision stands for rolling accurate merchant sections.

Of particular interest is the section devoted to problems of the productivity of labor, where the author convincingly proves the advantage of production standardization according to the norm-plan principle prior to a detailed planning of the norm and state plan. The favorable effect of the organization of wages based on the norm-plan for the work of all main shops of the plant is also pointed out.

In the concluding section, results are given on the reorganization of the economic activity. The expenditures per ruble of commodity output in 1959 was 98.9 kopeks (based on the price scale up to 1961); thus the plant became a profitable enterprise, and in 1960 this index was lowered to 94 kopeks (based on the same scale). The role in this matter of the competition which developed at the plant for the title of Brigade and Shock-Worker of Communist Labor is shown. The author discusses the leading personages and collectives that have been awarded this high rank and also the best efficiency experts and their individual suggestions, elucidates the problem of the organization of technical and economic studies for a wide circle of engineers and workers.

The book briefly relates the prospects for the development of the plant, the problems of financing the technical measures being carried out, and the use of the funds of the enterprise for improving the cultural conditions of the workers.

The book will be of benefit to a wide circle of leading workers of industrial enterprises (not only metallurgical) as a handbook for studying the experience of a successful reorganization of economic activity and the achievement of profitableness.

Unfortunately the edition is quite small (2000 copies).

It would be advantageous to reissue the book, supplementing it with problems of intraplant planning.

IMPROVING THE SANITARY CONDITIONS OF IRON-ORE SINTER PLANTS

A. V. Sheleketin and N. S. Karpushinskii, Metallurgical Press, Moscow, 1960
R. S. Suprunenko, Director of the Ventilation Group of the Power Laboratory, "Zaporozhstal'" Plant

The book is divided into two parts: "The Characteristics of Labor Conditions" and "Measures to Combat Harmful Effects." In the first part the authors analyze the technological process of agglomeration and indicate what main industrial hazards are encountered in the mining and sintering departments of a sinter plant.

In the second part the authors describe the basic methods to combat the hazards, especially dust. It is correctly pointed out in the book that the main methods of ridding the rooms of dust are air-tightness and aspiration of the dusting equipment.

Methods of purifying the gas of dust, moistening the dust on the conveyors, and the liquid removal of dust from the rooms of the sinter plant are described in detail. Methods of combatting vapors and protection from heat radiation are given in detail.

The authors managed to generalize Soviet and foreign experience and to write a good book that undoubtedly will be of considerable benefit not only to producers but also to workers in designing organizations.

Unfortunately, the edition is very small (1150 copies). We consider that it must be increased so that each worker in the sinter plant can acquire and read this useful book.

THE FOURTH PLENUM OF THE SCIENTIFIC-TECHNICAL SOCIETIES OF FERROUS AND NONFERROUS METALLURGY

I. Polyak

Translated from Metallurg, No. 4, p. 40, April, 1961

On February 9-10, 1961, the Fourth United Jubilee Plenum of the Scientific and Technical Societies of Ferrous and Nonferrous Metallurgy, dedicated to the 50th Anniversary of the Society of Metallurgists, was held in the October Hall of the Moscow House of Unions. Representatives of many metallurgical enterprises, scientific-research and designing institutes, social organizations, etc. participated in the work of the Plenum.

A. M. Samarin, corresponding member of the USSR Academy of Sciences, who gave a detailed description on the history of the origin and development of the society, reported on the 50th anniversary of the information of the Society of Metallurgists and the tasks of the members of the Scientific and Technical Societies. The reporter especially emphasized the outstanding role of the great Russian metallurgists, D. K. Chernov, A. A. Baikov, A. E. Grum-Grzhimailo, and others in founding the society and in the development of Russian and Soviet metallurgy. A. M. Samarin cited figures characterizing the increase in members of the Society of Metallurgists, pointed out the value of the society in later improvements of metallurgical production, and also dwelled on the fundamental problems of the members of the Scientific and Technical Society of Ferrous and Nonferrous Metallurgy during the period of expanded construction of the material and technological base of communism in our country.

Representatives of the Kuznetsk Metallurgical Combine and the "Krasnoe Sormovo" Plant presented memorial gifts and addresses to the Central Administration of the Scientific and Technical Society of Ferrous Metallurgy.

The reknown metallurgist, A. S. Tochinskii, a participant at the first organizational conference of the society in 1910, gave interesting recollections on the first steps of the Russian Metallurgical Society.

In the name of the All-Union Council of Trade Unions, V. A. Podrezko, Chairman of the Trade Union of Workers in the Metallurgical Industry, presented to thirty members of the Scientific and Technical Societies the diploma of the All-Union Council of Trade Unions for their great service in organizing and developing the Society of Metallurgists.

For active participation in the work of the Scientific and Technical Societies of Ferrous and Nonferrous Metallurgy, a large group of members of these societies were awarded the diploma of the Central Committee of the Trade Union of Workers in the Metallurgical Industry and the All-Union Council of Scientific and Technical Societies.

The participants of the plenum unanimously sent messages of greetings to the Central Committee of the Communist Party of the Soviet Union.

The Plenum discussed the plans of the work and budget for 1961 of the Central Administrations of the Scientific and Technical Societies of Ferrous and Nonferrous Metallurgy.

Soviet Journals Available in Cover-to-Cover Translation

ABBREVIATION	RUSSIAN TITLE	TITLE OF TRANSLATION	PUBLISHER	TRANSLATION BEGAN Vol.	Issue	Year
AÉ	Atomnaya énergiya	Soviet Journal of Atomic Energy	Consultants Bureau	1	1	1956
Akust. zh.	Akusticheskii zhurnal	Soviet Physics – Acoustics	American Institute of Physics	1	1	1955
	Antibiotiki	Antibiotics	Consultants Bureau	4	1	1959
Astr(on). zh(urn).	Astronomicheskii zhurnal	Soviet Astronomy–AJ	American Institute of Physics	34	1	1957
Avto(mat). svarka	Avtomaticheskaya svarka	Automatic Welding	British Welding Research Association (London)		1	1959
	Avtomatika i Telemekhanika	Automation and Remote Control	Instrument Society of America	27	1	1956
	Biofizika	Biophysics	National Institutes of Health*		1	1957
	Biokhimiya	Biochemistry	Consultants Bureau	21	1	1956
Byull. éksp(erim). biol. i med.	Byulleten' éksperimental'noi biologii i meditsiny	Bulletin of Experimental Biology and Medicine	Consultants Bureau	41	1	1959
DAN (SSSR) / Dokl(ady) AN SSSR	Doklady Akademii Nauk SSSR	The translation of this journal is published in sections, as follows:				
	Life Sciences	Doklady Biochemistry Section	American Institute of Biological Sciences	106	1	1956
	Life Sciences	Doklady Biological Sciences Sections (Includes: Anatomy, biophysics, cytology, ecology, embryology, endocrinology, evolutionary morphology, genetics, histology, hydrobiology microbiology, morphology, parasitology, physiology, zoology sections)	American Institute of Biological Sciences	112	1	1957
	Life Sciences	Doklady Botanical Sciences Sections (Includes: Botany, phytopathology, plant anatomy, plant ecology, plant embryology, plant physiology, plant morphology sections)	American Institute of Biological Sciences	112	1	1957
	Chemical Sciences	Proceedings of the Academy of Sciences of the USSR, Section: Chemical Technology	Consultants Bureau	106	1	1956
	Chemical Sciences	Proceedings of the Academy of Sciences of the USSR, Section: Chemistry	Consultants Bureau	106	1	1956
	Chemical Sciences	Proceedings of the Academy of Sciences of the USSR, Section: Physical Chemistry	Consultants Bureau	112	1	1957
	Earth Sciences	Doklady Earth Sciences Sections (Includes: Geochemistry, geology, geophysics, hydrogeology, mineralogy, paleontology, petrography, permafrost sections)	American Geological Institute	124	1	1959
	Earth Sciences	Proceedings of the Academy of Sciences of the USSR, Section: Geochemistry	Consultants Bureau	106-123	1-6	1957-1958
	Earth Sciences	Proceedings of the Academy of Sciences of the USSR, Sections: Geology	Consultants Bureau	106-123	1-6	1957-1958
	Mathematics	Doklady Soviet Mathematics	The American Mathematics Society	131	1	1961
	Physics	Soviet Physics–Doklady (Includes: Aerodynamics, astronomy, crystallography, cybernetics and control theory, electrical engineering, energetics, fluid mechanics, heat engineering, hydraulics, mathematical physics, mechanics, physics, technical physics, theory of elasticity sections)	American Institute of Physics	106	1	1956
	Physics	Proceedings of the Academy of Sciences of the USSR, Applied Physics Sections (does not include mathematical physics or physics sections)	Consultants Bureau	106-117	1	1956-1957
Derevoobrabat. prom-st'.	Derevoobrabatyvayushchaya promyshlennost'	Wood Processing Industry	Timber Development Association (London)		9	1959
	Élecktrosvyaz	Telecommunications	Massachusetts Institute of Technology*		1	1957
Éntom(ol). oboz(renie)	Éntomologicheskoe obozrenie	Entomological Review	American Institute of Biological Sciences	38	1	1959
Farmakol. (i) toksikol(ogiya)	Farmakologiya i toksikologiya	Pharmacology and Toxicology	Consultants Bureau	20	1	1957
FMM	Fizika metallov i metallovedenie	Physics of Metals and Metallography	Acta Metallurgica*	5	1	1957
Fiziol. zhurn. SSSR (im. Sechenova)	Fiziologicheskii zhurnal im. I. M. Sechenova	Sechenov Physiological Journal USSR	National Institutes of Health*		1	1957
Fiziol(ogiya) rast.	Fiziologiya rastenii	Plant Physiology	American Institute of Biological Sciences	4	1	1957
	Geokhimiya	Geochemistry	The Geochemical Society		1	1958
FTT	Fizika tverdogo tela	Soviet Physics–Solid State	American Institute of Physics	1	1	1959
Izmerit. tekh(nika)	Izmeritel'naya tekhnika	Measurement Techniques	Instrument Society of America		1	1959
Izv. AN SSSR, O(td). Kh(im). N(auk)	Izvestiya Akademii Nauk SSSR: Otdelenie khimicheskikh nauk	Bulletin of the Academy of Sciences of the USSR: Division of Chemical Sciences	Consultants Bureau		1	1952

continued

Izv. AN SSSR, O(td). T(ekhn). N(auk): Met(all). i top.	(see Met. i top.)					
Izv. AN SSSR Ser. fiz(ich).	Izvestiya Akademii Nauk SSSR: Seriya fizicheskaya	Bulletin of the Academy of Sciences of the USSR: Physical Series	Columbia Technical Translations		1	1954
Izv. AN SSSR Ser. geofiz.	Izvestiya Akademii Nauk SSSR: Seriya geofizicheskaya	Bulletin (Izvestiya) of the Academy of Sciences USSR: Geophysics Series	American Geophysical Union		1	1954
Izv. AN SSSR Ser. geol.	Izvestiya Akademii Nauk SSSR: Seriya geologicheskaya	Izvestiya of the Academy of Sciences of the USSR: Geologic Series	American Geological Institute		1	1958
Kauch. i rez.	Kauchuk i rezina	Soviet Rubber Technology	Research Association of British Rubber Manufacturers	18	1	1959
	Kinetika i kataliz	Kinetics and Catalysis	Consultants Bureau	1	3	1960
	Koks i khimiya	Coke and Chemistry USSR	Coal Tar Research Association (Leeds, England)		1	1958
Kolloidn. zh(urn).	Kolloidnyi zhurnal	Colloid Journal	Consultants Bureau	14	1	1952
	Kristallografiya	Soviet Physics – Crystallography	American Institute of Physics	2	1	1957
Metalov. i term. obrabot. metal.	Metallovedenie i termicheskaya obrabotka metallov	Metal Science and Heat Treatment of Metals				
	Metallurg	Metallurgist	Acta Metallurgica	6	1	1958
Met. i top.	Metallurgiya i topliva	Russian Metallurgy and Fuels	Acta Metallurgica		1	1957
Mikrobiol.	Mikrobiologiya	Microbiology	Eagle Technical Publications		1	1960
OS	Optika i spektroskopiya	Optics and Spectroscopy	American Institute of Biological Sciences	26	1	1957
	Pochvovedenie	Soviet Soil Science	American Institute of Physics		6	1959
	Priborostroenie	Instrument Construction	American Institute of Biological Sciences		1	1958
Pribory i tekhn. éks(perimenta)	Pribory i tekhnika éksperimenta	Instruments and Experimental Techniques	British Scientific Instrument Research Association		1	1959
Prikl. matem. i mekh.	Prikladnaya matematika i mekhanika	Applied Mathematics and Mechanics	Instrument Society of America		1	1957
PTÉ	(see Pribory i tekhn. éks.)		American Society of Mechanical Engineers		1	1958
	Problemy Severa	Problems of the North	National Research Council of Canada			
Radiotekh.	Radiotekhnika	Radio Engineering	Massachusetts Institute of Technology*	12	1	1957
Radiotekh. i élektronika	Radiotekhnika i élektronika	Radio Engineering and Electronics	Massachusetts Institute of Technology*	2	1	1957
	Stanki i instrument	Machines and Tooling	Production Engineering Research Assoc.		1	1959
	Stal'	Stal (In English)	Iron and Steel Institute		1	1959
Stek. i keram.	Steklo i keramika	Glass and Ceramics	Consultants Bureau	13	1	1956
Svaroch. proiz-vo	Svarochnoe proizvodstvo	Welding Production	British Welding Research Association		4	1959
Teor. veroyat. i prim.	Teoriya veroyatnostei i ee primenenie	Theory of Probability and Its Applications	Society for Industrial and Applied Mathematics		1	1956
Tsvet. Metally	Tsvetnye metally	Nonferrous Metals	Primary Sources		1	1960
UFN	Uspekhi fizicheskikh Nauk	Soviet Physics – Uspekhi (partial translation)	American Institute of Physics	66	1	1958
UKh	Uspekhi khimii	Russian Chemical Reviews	The Chemical Society (London)		1	1960
UMN	Uspekhi matematicheskikh nauk	Russian Mathematical Surveys	London Mathematical Society	15	1	1960
Usp. fiz. nauk	(see UFN)					
Usp. khim(ii)	(see UKh)					
Usp. matem. nauk	(see UMN)					
Usp. sovr. biol.	Uspekhi sovremennoi biologii	Russian Review of Biology	Oliver and Boyd		48	1959
Vest. mashinostroeniya	Vestnik mashinostroeniya	Russian Engineering Journal	Production Engineering Research Assoc.		4	1959
Vop. gem. i per. krovi	Voprosy gematologii i perelivaniya krovi	Problems of Hematology and Blood Transfusion	National Institutes of Health*		1	1957
Vop. onk.	Voprosy onkologii	Problems of Oncology	National Institutes of Health*		1	1957
Vop. virusol.	Voprosy virusologii	Problems of Virology	National Institutes of Health*		1	1957
Zav(odsk). lab(oratoriya)	Zavodskaya laboratoriya	Industrial Laboratory	Instrument Society of America	25	1	1959
ZhAKh Zh. anal(it). khimii	Zhurnal analiticheskoi khimii	Journal of Analytical Chemistry USSR	Consultants Bureau	7	1	1952
ZhETF Zh. éksperim. i teor. fiz.	Zhurnal éksperimental'noi i teoreticheskoi fiziki	Soviet Physics–JETP	American Institute of Physics	28	1	1955
ZhFKh Zh. fiz. khimii	Zhurnal fizicheskoi khimii	Russian Journal of Physical Chemistry	The Chemical Society (London)		7	1959
ZhMÉI Zh(urn). mikrobiol. épidemiol. i immunobiol.	Zhurnal mikrobiologii, épidemiologii i immunobiologii	Journal of Microbiology, Epidemiology and Immunobiology	National Institutes of Health*		1	1957
ZhNKh Zh(urn). neorgan(ich). khim(ii)	Zhurnal neorganicheskoi khimii	The Russian Journal of Inorganic Chemistry	The Chemical Society (London)		1	1959
ZhOKh Zh(urn). obshch(ei) khimii	Zhurnal obshchei khimii	Journal of General Chemistry USSR	Consultants Bureau	19	1	1949
ZhPKh Zh(urn). prikl. khimii	Zhurnal prikladnoi khimii	Journal of Applied Chemistry USSR	Consultants Bureau	23	1	1950
ZhSKh Zh(urn). strukt. khimii	Zhurnal strukturnoi khimii	Journal of Structural Chemistry	Consultants Bureau	1	1	1960
ZhTF Zh(urn). tekhn. fiz.	Zhurnal teknicheskoi fiziki	Soviet Physics–Technical Physics	American Institute of Physics	26	1	1956
Zh(urn). vyssh. nervn. deyat. (im. Pavlova)	Zhurnal vysshei nervnoi deyatel'nosti (im. I. P. Pavlova)	Pavlov Journal of Higher Nervous Activity	National Institutes of Health*		1	1958

*Sponsoring organization. Translation through 1960 issues is a publication of Pergamon Press.

SIGNIFICANCE OF ABBREVIATIONS MOST FREQUENTLY ENCOUNTERED IN SOVIET PERIODICALS

FIAN	Phys. Inst. Acad. Sci. USSR.
GDI	Water Power Inst.
GITI	State Sci.-Tech. Press
GITTL	State Tech. and Theor. Lit. Press
GONTI	State United Sci.-Tech. Press
Gosénergoizdat	State Power Engr. Press
Goskhimizdat	State Chem. Press
GOST	All-Union State Standard
GTTI	State Tech. and Theor. Lit. Press
IL	Foreign Lit. Press
ISN (Izd. Sov. Nauk)	Soviet Science Press
Izd. AN SSSR	Acad. Sci. USSR Press
Izd. MGU	Moscow State Univ. Press
LÉIIZhT	Leningrad Power Inst. of Railroad Engineering
LÉT	Leningrad Elec. Engr. School
LÉTI	Leningrad Electrotechnical Inst.
LÉTIIZhT	Leningrad Electrical Engineering Research Inst. of Railroad Engr.
Mashgiz	State Sci.-Tech. Press for Machine Construction Lit.
MÉP	Ministry of Electrotechnical Industry
MÉS	Ministry of Electrical Power Plants
MÉSÉP	Ministry of Electrical Power Plants and the Electrical Industry
MGU	Moscow State Univ.
MKhTi	Moscow Inst. Chem. Tech.
MOPI	Moscow Regional Pedagogical Inst.
MSP	Ministry of Industrial Construction
NII ZVUKSZAPIOI	Scientific Research Inst. of Sound Recording
NIKFI	Sci. Inst. of Modern Motion Picture Photography
ONTI	United Sci.-Tech. Press
OTI	Division of Technical Information
OTN	Div. Tech. Sci.
Stroiizdat	Construction Press
TOÉ	Association of Power Engineers
TsKTI	Central Research Inst. for Boilers and Turbines
TsNIÉL	Central Scientific Research Elec. Engr. Lab.
TsNIÉL-MÉS	Central Scientific Research Elec. Engr. Lab.-Ministry of Electric Power Plants
TsVTI	Central Office of Economic Information
UF	Ural Branch
VIÉSKh	All-Union Inst. of Rural Elec. Power Stations
VNIIM	All-Union Scientific Research Inst. of Meteorology
VNIIZhDT	All-Union Scientific Research Inst. of Railroad Engineering
VTI	All-Union Thermotech. Inst.
VZÉI	All-Union Power Correspondence Inst.

Note: Abbreviations not on this list and not explained in the translation have been transliterated, no further information about their significance being available to us - Publisher.